3.0 Affected Environment

Collectively, the area encompassing the deepwater port locations and transit routes is called the Region of Influence (ROI). The ROI for specific resources is further defined as needed. Proposed Project alternatives are located within the same general vicinity as the proposed Project location, and the affected area would be similar for all locations.

3.1 Water Resources

The proposed Port Ambrose Deepwater Port (Port Ambrose Project, Port or Project) is located in the New York Bight region of the Atlantic Ocean within an entirely marine environment. Marine waters, as defined in this document, include federal waters of the Outer Continental Shelf (OCS) extending from 3.0 nautical miles offshore seaward to the U.S. Exclusive Economic Zone (EEZ) and New York state waters landward of 3.0 nautical miles offshore. The ROI for impacts on water resources includes the area within and directly adjacent to the proposed Port location and Mainline route that could be affected by construction, operation, and decommissioning of the proposed Port Ambrose Project.

The physical characteristics and quality of the water resources directly affect the ability to maintain and support the surrounding ecosystem. In coastal and marine environments, these characteristics are largely controlled by natural river drainage, water circulation, precipitation, atmospheric deposition (dust), solar radiation, and evaporation.

The parameters used to evaluate these characteristics are the physical oceanographic setting (waves, currents, and tides), water quality (temperature, turbidity and dissolved oxygen [DO]) and existing natural and anthropogenic contaminants (organic and inorganic material).

The oceanographic setting includes a summary of the available data on waves, currents, and tides under normal and extreme weather conditions, including seasonal variations. The baseline water quality constituents include salinity, temperature, DO, turbidity, and nutrients.

3.1.1 Physical Oceanography

Bathymetry

The proposed Project is located on the continental shelf in the apex of the New York Bight. The bathymetry of the New York Bight region, as presented in Figure 3-1.1, is characterized by water depths ranging from 30 to 100 feet. In the vicinity of the proposed Port facilities, water depth is approximately 103 feet and is approximately 46 feet at the subsea tie-in (SSTI) (OSI 2012). The New York Bight seafloor is characterized by undulating sand ridges and troughs and numerous shore attached shoals (Byrnes et al. 2004). The most significant bathymetric feature of the region is the Hudson Shelf Valley, a deep relic submarine valley that bisects the New York Bight Apex. This feature was a valley of the Hudson River that formed when sea levels were lower (Byrnes et al. 2004). This valley is located approximately 13.5 nautical miles southwest of the proposed Project.

In addition to these natural submarine features, there are also anthropogenic bathymetric features within the New York Bight. These include many areas within the New York Bight that have been used for ocean disposal of dredge spoils and other materials, creating mounds of sediment and debris. A significant example of such an artificial rise in bathymetry within the New York Bight is the Historic Area Remediation Site (HARS), which is located approximately 12 nautical miles west of the proposed Project area. Like the HARS, some areas may include sand capping used to stabilize dredge sediments containing contaminants. There are no significant anthropogenic bathymetric features near the proposed Port facilities or along the proposed Mainline route.

Figure 3.1-1. Bathymetry and Water Monitoring Points

Wave Action

Wave height and direction data have been analyzed for the proposed Project area, based on historical data sets for the New York Bight. Waves in this area are a function of both local wind patterns and the more regional North Atlantic swells. The dominant wind direction in the vicinity of the proposed Port facilities is from the southwest/south towards the northeast/north. The predominant direction of significant waves is towards the northwest and north (FOE 2012). Figure 3.1-2 shows a rose diagram that includes wave height and direction at the proposed Port location.

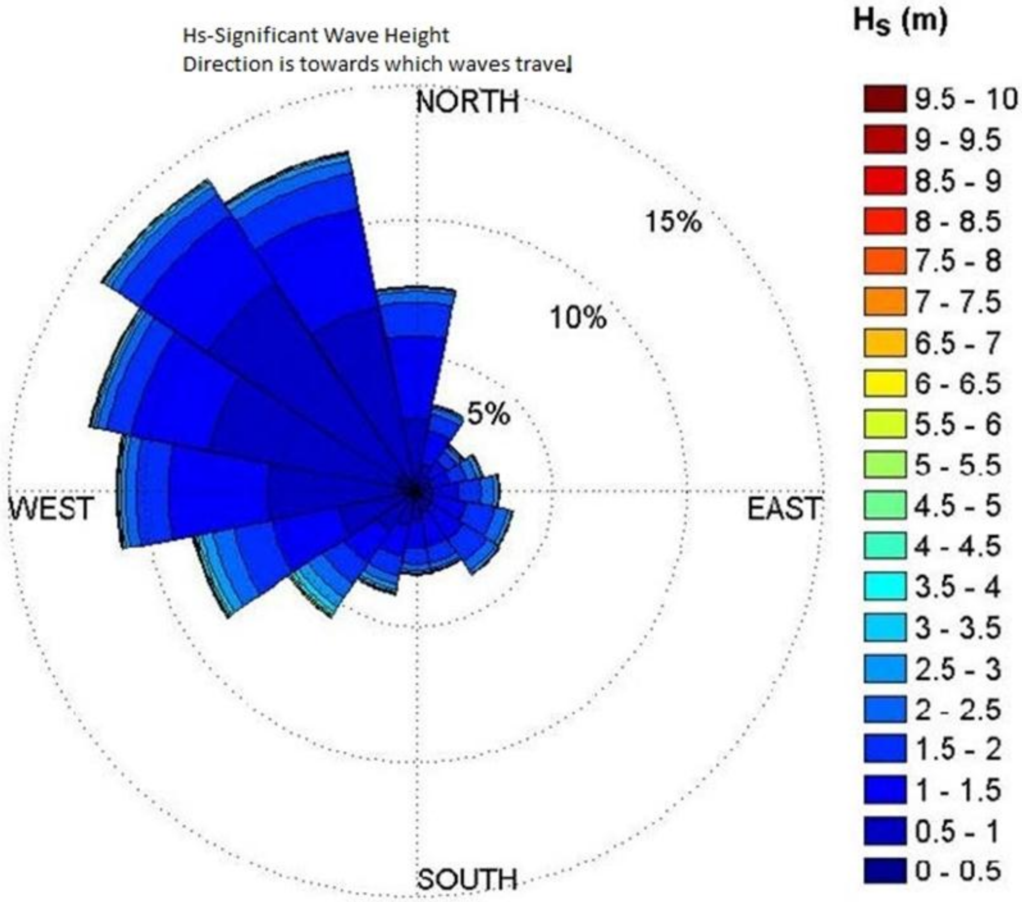

Figure 3.1-2. Wave Rose at Proposed Port Location

Waves in the vicinity of the proposed Port facilities are generally average, less than 6.6 feet in height. Wave height hindcast analyses for extreme storm events (combined tropical and subtropical storms) are predicted to range from 15.25 feet for the one-year event to 28.02 feet for the 100-year event. The predicted values for wave height for various storm types are presented in Table 3.1-1.

Table 3.1-1. Extreme Values of Significant Wave Height in Combined Storms

Return Period (years)	Height (feet)	Height (meters)
1	15.25	4.65
5	19.88	6.06
10	22.05	6.72
20	24.02	7.32
50	26.41	8.05
100	28.02	8.54
200	32.00	9.75

Source: Metocean Criteria Study FOE 2012.

200-year height established from "Super Storm Sandy" at Buoy #44065 (32.5 feet) and Buoy #44025 (31 feet), October 29, 2012.

Tides

Tidal currents in the New York Bight region are dominated by the regional lunar semi-diurnal tide referred to as the M2 tide. This semi-diurnal tide has a tidal period of 12.42 hours, maximum speed in the range of 0.2 to 0.3 knots, and maximum amplitude of approximately 24 inches (FOE 2012). Tidal currents in the ROI generally exhibit a northwest-southeast orientation (Byrnes et al. 2004). This indicates that the currents in the region are primarily wind-driven and only slightly influenced by relatively limited tidal effects as discussed below.

Tidal data for the National Oceanic and Atmospheric Administration (NOAA) Sandy Hook tide station (NOAA Tide Station 8531680) located near the tip of Sandy Hook peninsula was obtained. This is the closest tide station in the vicinity of the proposed Port facilities. For the most recent statistically evaluated (1983-2000) period of record, the mean tidal range at this station (mean low water [0.20 feet] to mean high water [4.90 feet]) was approximately 4.70 feet, and the diurnal range (mean higher high water [5.22 feet] to mean lower low water [0.20 feet]) was approximately 5.22 feet. Mean sea level is approximately 2.55 feet.

Winds

Winds in the New York Bight region are and have been historically recorded at NOAA NDBC Buoy No. 44025. A wind rose from annually averaged data collected at NDBC Station No. 44025 is included as Figure 3.1-3 and indicates that prevailing wind is generally from the south-southwest (wind direction is shown from the direction it is blowing) typical for the Atlantic Coast.

A seasonal USGS study conducted during the winter/spring of 1999-2000 (Butman et al. 2003) indicated prevailing winds blew towards the east-southeast (i.e., offshore, away from the shoreline) with stronger winds in the range of 23 to 39 knots. As discussed above, annually averaged data presented in Figure 3.1-3 indicate prevailing winds blowing towards the north-northeast (i.e., onshore, towards Long Island), with stronger winds in the range of 11 to 21 knots. These winter/spring wind patterns, as compared to annually averaged wind patterns, are consistent with the finding that winds and associated wind-driven currents are typically stronger during the winter/spring months than during other times of the year. The data also indicates that wind direction is generally towards the south and east during the winter/spring months and generally towards the north and west during other times of the year.

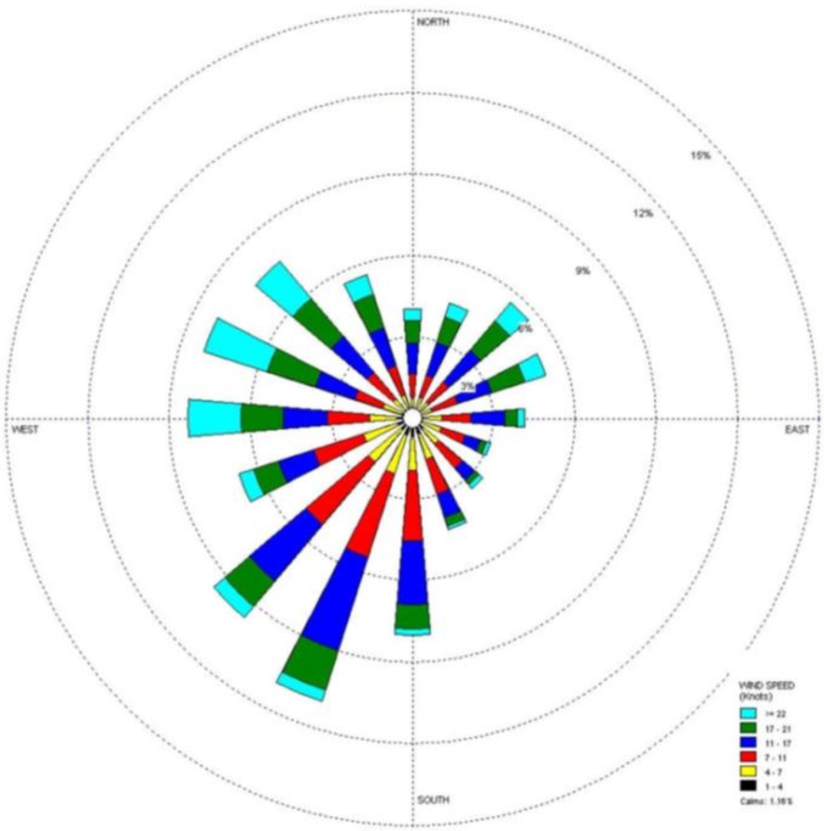

Figure 3.1-3. Wind Rose Plot for NDBC Station No. 44025

Currents

The New York Bight is affected by two large current systems: the northeastward flowing Gulf Stream current, located offshore of the New York Bight, and the south and southeastward flowing shelf water current, a cool, freshwater current that flows down from Canada (an extension of the Labrador current) parallel to the northeast shoreline. The interaction of these two current systems results in the establishment of a cyclonic (counterclockwise) gyre in the New York Bight (see Figure 3.1-4). However, surface currents in the New York Bight area are primarily wind-driven, as discussed below.

A study by the U.S. Geologic Survey (USGS) from 1999 to 2000 was performed (Butman et al. 2003) at a monitoring station identified as Station D (see Figure 3.1-1) located approximately 8.6 nautical miles west of the proposed Port facilities at a water depth of approximately 85 feet, and represents wind along with current velocity and directional conditions and wind in the open water portion of the New York Bight. The results are summarized in Table 3.1-2.

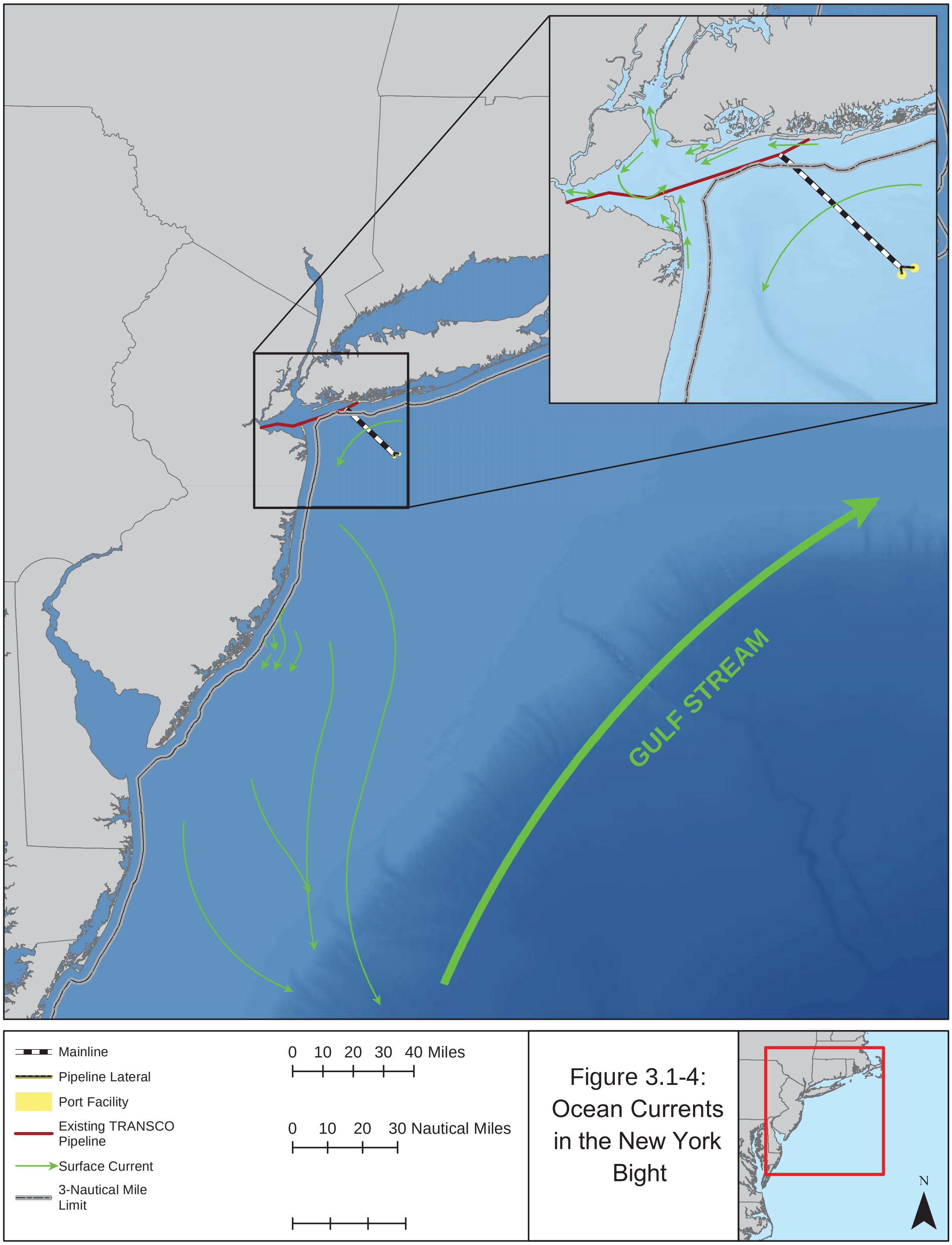

Figure 3.1-4. **Ocean Currents in the New York Bight**

Current velocities were reported during this time period with a mean surface current ranging from 1.2 to 1.4 knots, and maximum currents ranging from 1.9 to 2.7 knots. Bottom currents, measured 82 feet below the water surface, were significantly lower in velocity than surface currents, with mean velocities ranging from 0.12 to 0.16 knots. The predominant wind direction was towards the southeast, and the predominant surface current direction was similarly towards the southeast and south-southeast. It was theorized as part of this study that current and direction are controlled by wind speed and direction.

Table 3.1-2. Summary of Wind and Current Data at Station D – December 5, 1999 to April 15, 2000

Parameter	Surface Currents Unfiltered (Wind and Tide)	Surface Currents Low Pass Filtered (Wind)	Bottom Currents Unfiltered (Wind and Tide)	Bottom Currents Low Pass Filtered (Wind)
Prevailing Wind Direction	Towards ESE			
Prevailing Current Direction	Towards SE	Towards SE	Towards ESE	Towards SW
Maximum Current	2.6 knots towards SE	1.8 knots towards SW	0.7 knot towards E	0.4 knot towards SE
Mean Current	1.3 knots (±0.4 knots) towards SE	1.1 knots (±0.3 knots) towards SE	0.16 knot (±0.1 knots) towards SE	0.12 knot (±0.08 knots) towards SSE
Source: Butman et al. 2003; Byrnes et al. 2004.				

Surface current velocity in the ROI was also estimated based on a statistical study using Rutgers University's coastal ocean dynamics applications radar (CODAR) system. This analysis indicated that over 53 percent of the near surface current velocities ranged from 0.12 to 0.35 knots, with the weighted mean current velocity estimated at approximately 0.31 knots. Table 3.1-3 provides a breakdown of near surface currents by speed and direction in the vicinity of the proposed Port facilities, with the shaded rows representing the dominant current velocity range. In addition, this statistical study estimates no dominant current direction. The flows towards the south (quadrant from SW to SE) occur slightly more frequently than flows in other directions, but the difference is not considered to be statistically significant.

The CODAR current velocities appear to underestimate surface current compared to previous studies (Butman et al. 2003), but are consistent with those recorded during field studies in the winter of 2012 using an acoustic doppler current profiler (ADCP) in the proposed Port area and along the proposed Mainline route.

Project-specific ADCP data collection efforts were limited to the January to February time period in 2012. Figures 3.1-5 and 3.1-6 show profiles at two of the monitoring stations (20 and 33) identified on Figure 3.1-1, confirming the lower values.

In general, surface currents are wind driven directing flow towards the south and southeast during the winter and spring months and towards the north and northwest during the summer and fall months. Current velocities at the surface range from 0.4 to 0.8 knots with higher currents ranging from 1.2 to 1.6 knots during the winter and spring. Currents at depth are less affected by winds and have a lower velocity of approximately 0.12 to 0.16 knots. These currents often flow in a different (and sometimes opposite) direction than the surface current.

Table 3.1-3. CODAR Statistical Current Summary

Current Speed (cm/s)	Direction (towards which currents flow)																
	0 N	22.5 NNE	45 NE	67.5 ENE	90 E	112.5 ESE	135 SE	157.5 SSE	180 S	202.5 SSW	225 SW	247.5 WSW	270 W	292.5 WNW	315 NW	337.5 NNW	Sum (%)
0-3	0.21	0.25	0.17	0.19	0.18	0.19	0.15	0.17	0.23	0.24	0.24	0.20	0.22	0.23	0.18	0.24	3.31
3-6	0.57	0.54	0.54	0.47	0.49	0.44	0.56	0.60	0.59	0.55	0.60	0.66	0.50	0.63	0.54	0.61	8.88
6-9	0.87	0.71	0.73	0.68	0.62	0.72	0.84	0.83	0.85	0.88	0.80	0.89	0.88	0.79	0.79	0.75	12.64
9-12	0.84	0.72	0.83	0.80	0.81	0.93	0.92	0.92	0.86	1.01	1.01	1.04	1.01	0.98	0.80	0.80	14.30
12-15	0.83	0.89	0.80	0.86	0.84	0.87	1.03	0.96	1.00	0.83	0.96	1.09	0.94	0.87	0.81	0.83	14.43
15-18	0.71	0.76	0.76	0.76	0.75	0.79	0.89	0.86	0.80	0.79	0.83	0.82	0.73	0.59	0.69	0.68	12.21
18-21	0.56	0.67	0.75	0.57	0.66	0.71	0.76	0.71	0.69	0.71	0.62	0.61	0.55	0.40	0.55	0.59	10.10
21-24	0.43	0.54	0.59	0.54	0.42	0.60	0.54	0.58	0.58	0.49	0.57	0.55	0.38	0.32	0.28	0.37	7.78
24-27	0.26	0.42	0.43	0.41	0.34	0.41	0.38	0.44	0.35	0.38	0.34	0.39	0.32	0.26	0.24	0.26	5.62
27-30	0.16	0.30	0.34	0.33	0.28	0.29	0.25	0.26	0.30	0.20	0.22	0.21	0.21	0.16	0.13	0.17	3.81
30-33	0.11	0.20	0.23	0.23	0.18	0.17	0.18	0.21	0.20	0.19	0.20	0.14	0.12	0.08	0.05	0.11	2.63
33-36	0.06	0.10	0.15	0.13	0.10	0.14	0.09	0.11	0.09	0.17	0.13	0.09	0.04	0.03	0.03	0.04	1.51
36-39	0.04	0.09	0.09	0.07	0.06	0.05	0.07	0.08	0.09	0.13	0.11	0.06	0.02	0.01	0.02	0.03	1.01
39-42	0.03	0.06	0.06	0.04	0.03	0.03	0.04	0.03	0.06	0.05	0.08	0.03	0.01	0.01	0.01	0.01	0.60
42-45	0.02	0.04	0.03	0.02	0.02	0.02	0.03	0.04	0.03	0.04	0.02	0.02	0.01	0.00	0.00	0.01	0.35
45-48	0.01	0.01	0.03	0.01	0.02	0.01	0.01	0.03	0.03	0.05	0.02	0.01	0.00	0.01	0.00	0.00	0.27
48-51	0.01	0.02	0.01	0.02	0.00	0.00	0.01	0.05	0.03	0.03	0.03	0.01	0.00	0.00	0.00	0.00	0.21
51-54	0.01	0.01	0.02	0.00	0.00	0.00	0.00	0.01	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.12
54-57	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.08
57-60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.05
60-63	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.03
63-66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02
66-69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02
69-72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
72-75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum %	5.73	6.35	6.58	6.15	5.82	6.37	6.78	6.92	6.84	6.87	6.81	6.84	5.94	5.38	5.12	5.50	100

Highlighted rows indicate prevailing current speeds; >53 percent of current speeds are in 6 to 18 m/s range.
cm/s = centimeters per second

Velocity and wind direction data collected using a boat-mounted ADCP along the proposed Mainline route during the marine survey showed similar data to the proposed Port area, leading to the conclusion that conditions are similar along the proposed Mainline route.

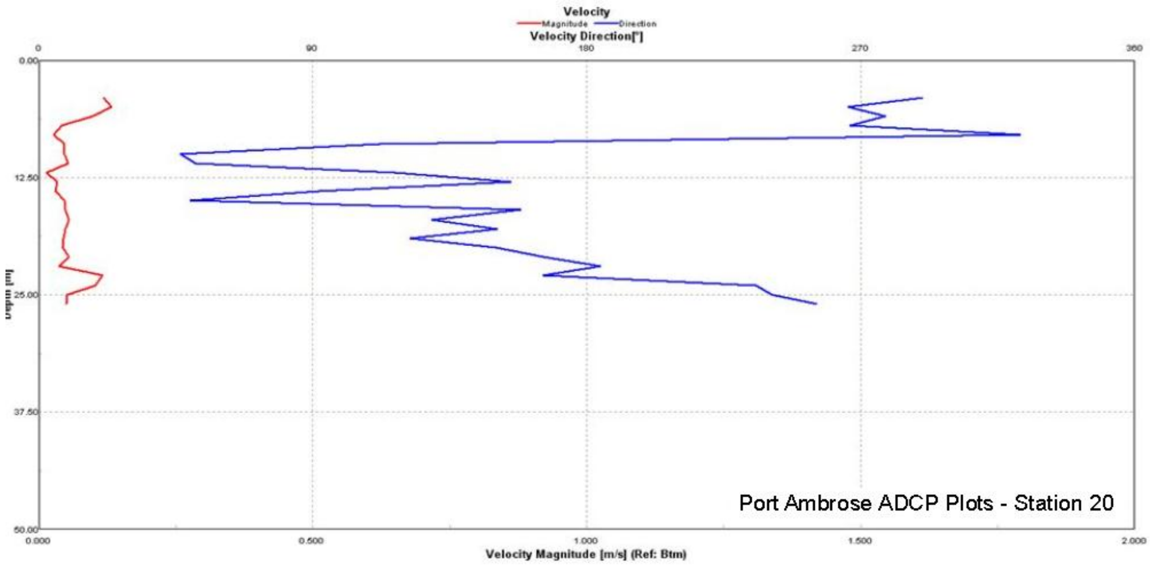

Figure 3.1-5. ADCP Current Log - Monitoring Station 20

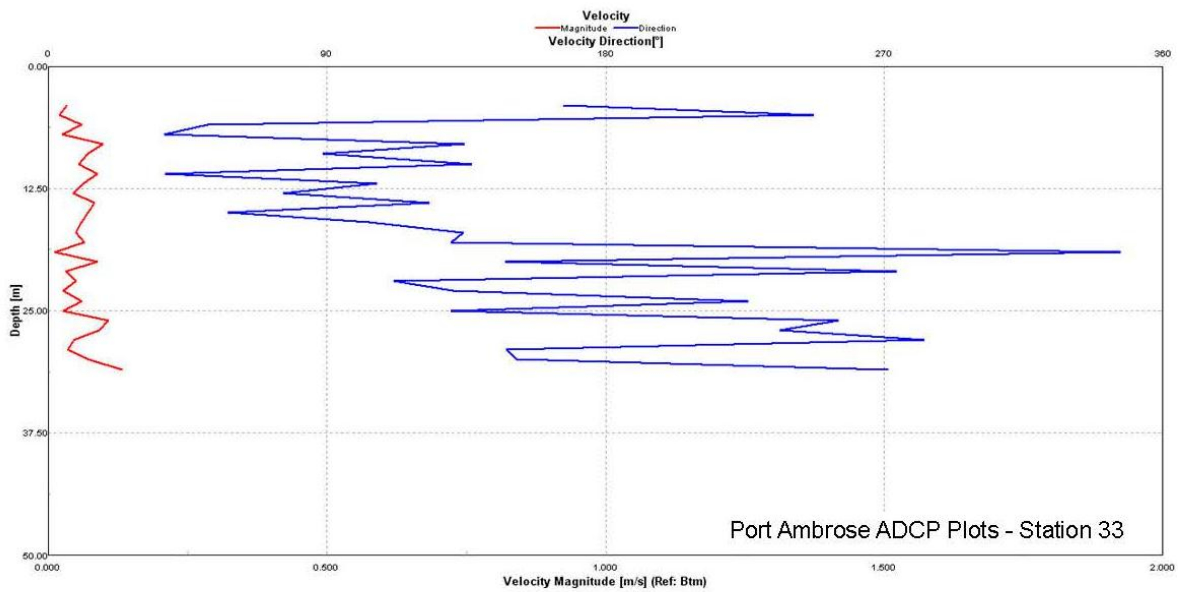

Figure 3.1-6. ADCP Current Log - Monitoring Station 33

3.1.2 Water Quality

All waters in New York State are assigned a letter classification that denotes their best uses. Letter classes such as A, B, C, and D are assigned to fresh surface waters, and SA, SB, SC, I, and SD to saline (marine) surface waters. The New York State Department of Environmental Conservation (NYSDEC) water quality classification for state jurisdictional waters is class SB for marine waters. Class SB saline surface water are considered for both primary and secondary contact recreation and fishing. These waters are suitable for fish, shellfish, and wildlife propagation and survival.

Water quality within the New York Bight is strongly controlled by the prevailing currents of the Gulf Stream and Labrador currents. However, the significant freshwater input from the Hudson River has a major effect to overall water quality. Water quality characterization studies conducted by Benway and Jossi (1998), historic water information from the marine monitoring station located on the Ambrose Light Station (NOAA 2012a), and Project-specific water quality monitoring data collected in January and February 2012 (OSI 2012) are summarized below.

Temperature

Water temperature affects the type of biota present in a given ecosystem. Near surface temperatures affect the amount and occurrence of algae and both near and subsurface temperature can have a direct effect to flow patterns and water density. In order to understand the potential temperature impacts from construction, operation, and decommissioning, the proposed Port's water intake and discharges in relation to ambient temperature patterns needs to be understood.

Temperature of surface seawater has been recorded at NOAA's Ambrose Light Station, located approximately 18.9 nautical miles northwest of the proposed Port area. The temperature data collected from November 1984 to May 2008 is presented in Figure 3.1-7. The figure shows a quartile plot of monthly minimum, 25th percentile, median, 75th percentile, and maximum sea surface temperatures (NOAA 2012b). Median sea surface temperatures at Ambrose Light Station range from a low of approximately 39 degrees Fahrenheit (°F) (4 degrees Celsius [C°]) in February to a high of approximately 72°F (22°C) in August.

Mean surface and bottom water temperature data collected from 1978 to 1992 (Benway and Jossi 1998) demonstrate temperature stratification from late April to late October, with peak stratification from July to September. During these summer months mean surface water temperatures range from 68 to 72°F (20 to 22°C), while temperatures in the bottom waters range from 50 to 57°F (10 to 14°C). Starting in November through the winter, mean temperatures are similar at the surface and bottom, indicating that the water column is generally well-mixed (Benway and Jossi 1998).

The state of New York (NYDOS 2013) mapped seasonal stratification trends in the New York Bight using average monthly sea surface temperature, satellite imagery, historical radiometer data and conductivity-temperature-depth data collected during various marine surveys. The results of this analysis indicate a seasonal pattern of well-mixed, relatively uniform conditions during the fall and winter, development of stratified conditions during the spring and more substantial stratification during the summer.

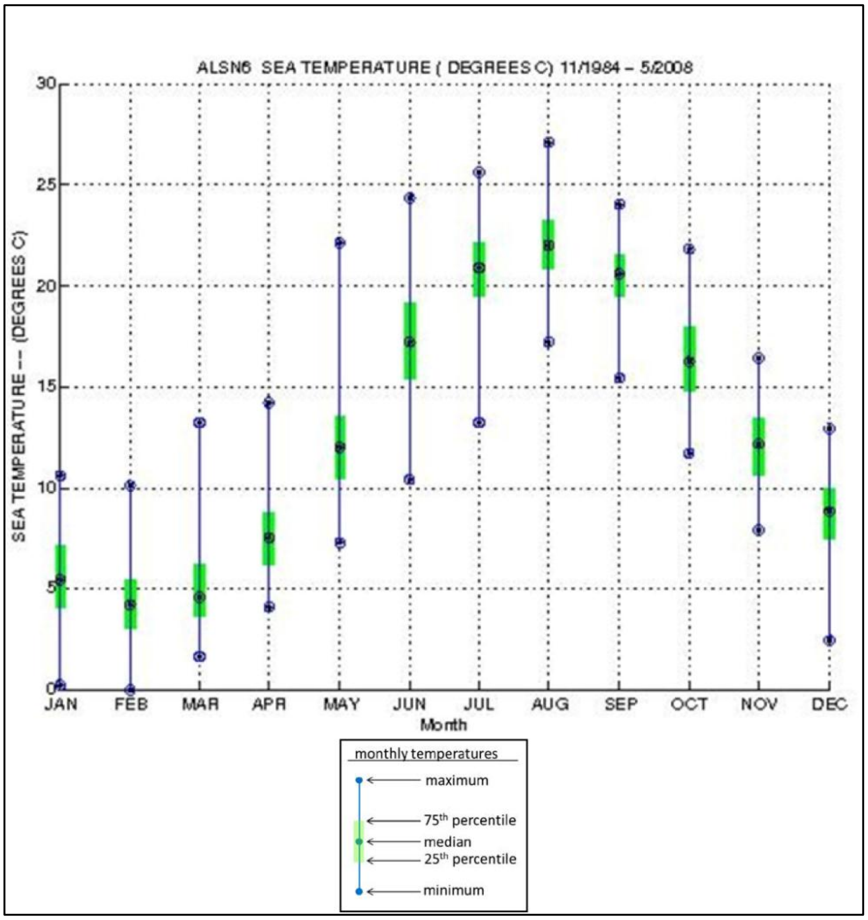

Figure 3.1-7. Temperature Statistics Ambrose Light

Salinity

Salinity data has been historically collected at the NOAA National Data Buoy Center (NDBC) Buoy No. 44025, which is located approximately 10.3 nautical miles east of the proposed Port and is identified on Figure 3.1-1. Data has indicated that surface salinity is similar to the open ocean (salinity greater than 30 parts per thousand [ppt]). A summary of the data for 2008, 2009 and the winter of 2010 are presented in Table 3.1-4.

Table 3.1-4. Monthly Salinity Data NDBC No. Buoy 44025

Month	2008		2009		2010	
	Average Salinity (ppt)	Salinity Range (min to max) (ppt)	Average Salinity (ppt)	Salinity Range (min to max) (ppt)	Average Salinity (ppt)	Salinity Range (min to max) (ppt)
January	32.2	31.9 to 32.4	32.8	32.1 to 33.4	33.2	32.7 to 33.8
February	32.2	31.4 to 32.5	32.9	32.6 to 33.4	32.9	32.5 to 33.0
March	31.8	30.7 to 32.3	32.7	32.1 to 33.2	32.5	32.5 to 32.5
April	32.0	31.3 to 32.6	32.1	31.7 to 32.7	--	--
May	31.3	30.5 to 32.1	31.5	31.0 to 32.1	--	--
June	30.7	30.3 to 31.0	31.3	30.7 to 31.7	--	--
July	30.8	30.2 to 31.4	30.8	29.2 to 31.4	--	--

Month	2008		2009		2010	
	Average Salinity (ppt)	Salinity Range (min to max) (ppt)	Average Salinity (ppt)	Salinity Range (min to max) (ppt)	Average Salinity (ppt)	Salinity Range (min to max) (ppt)
August	31.2	30.6 to 31.7	30.5	26.3 to 31.4	--	--
September	31.7	30.3 to 32.7	32.3	30.5 to 33.4	--	--
October	32.2	31.8 to 32.5	32.4	30.7 to 33.0	--	--
November	32.4	32.2 to 32.6	32.4	32.0 to 32.7	--	--
December	32.5	31.6 to 32.9	32.7	31.6 to 33.6	--	--
Annual Average (Annual Range)	31.8	30.2 to 32.9	32.0	26.3 to 33.6	32.9	26.3 to 33.8
Period Average	32.0					
Period Range	26.3 to 33.8					

Salinity measurement recorded at a depth of 3.28 feet beneath water surface, generally on an hourly basis.
Source: NOAA 2012c.

Salinity measurements were recorded at the buoy at a depth of 3.28 feet. The recorded values range from 31 to 33 ppt, with an average value of 32.0 ppt, except for a few low measurements during the summer of 2009 (NOAA 2012c).

Salinity profile measurements were taken as part of the January/February 2012 marine survey. In the vicinity of the proposed Port facilities (at Station 29), salinity ranged from 31.4 ppt at the surface to 33.0 ppt at a depth of approximately 112 feet. These data are in the same range as the historical buoy salinity data.

This survey also shows that salinity decreases slightly moving northwest along the proposed Mainline route, due to increased contributions of freshwater flows from the Hudson River and other smaller mainland sources. At Station 4 (Figure 3.1-8), approximately 2.6 nautical miles south of the coastline, salinity ranged from 31.4 ppt at the surface to 33.2 ppt at an approximate depth of 58 feet, but still within open ocean ranges. This range was also not depth dependent. However, it is suspected that because these salinity profiles were observed during the winter, that during the summer there may be some vertical stratification with higher salinity at depth.

Dissolved Oxygen (DO)

The concentration of oxygen in the gaseous form that is dissolved in water is measured as DO. DO is essential for aquatic plant and animal biology. It is typically measured in milligrams per liter (mg/L) or as a percent of saturation. Surface waters are generally near saturation. Saturation decreases with depth due to consumption by biota or oxidation by detritus.

DO concentration profiles were measured during the January/February 2012 marine survey in the vicinity of the proposed Port facilities and along the proposed Mainline route. As illustrated in Figure 3-1.8, DO concentrations approached saturation levels across the entire water column. Observed DO concentrations in the surface water ranged from 9.8 to 10.0 mg/L, and at depths of 100 to 130 feet approached 9.5 mg/L. It should be noted that DO values vary in conjunction with variations in seawater temperature and salinity. The DO pattern indicates no oxygen stress at any sampling location; the well-mixed conditions allowed uniform DO concentrations throughout this water column, as would be expected during the winter months.

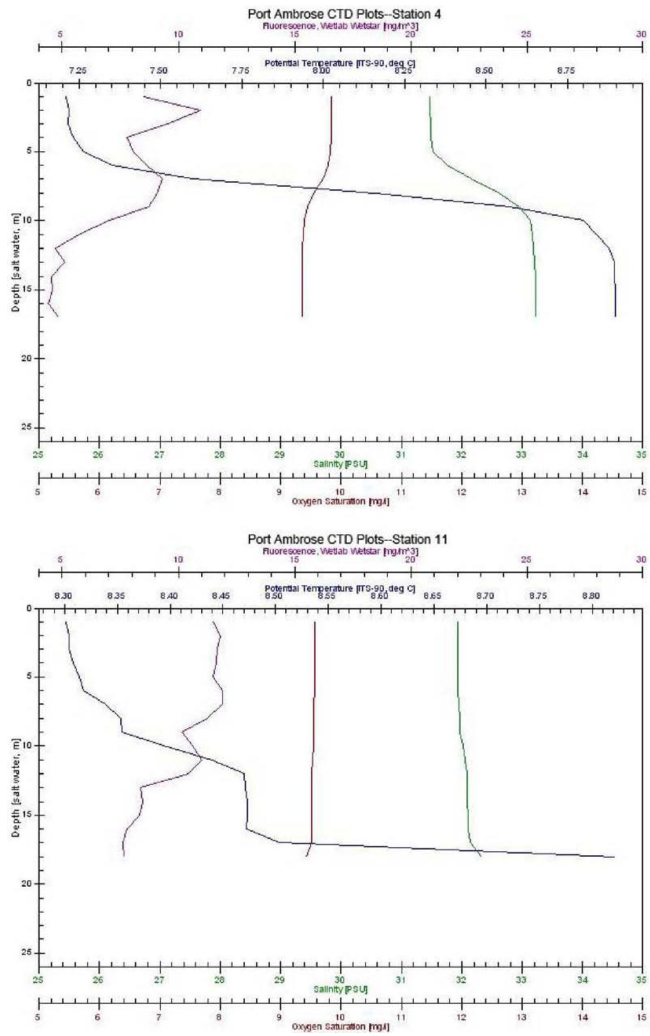

Figure 3.1-8. Temperature, Salinity, Dissolved Oxygen and Fluorescence Variation Stations 4 and 11

The U.S. Army Corps of Engineers (USACE 2008) has observed DO stratification in some areas during the summer months when DO saturation near the bottom can drop to a range of 70 to 80 percent or 10 to 30 percent less than the surface water values. This pattern has been attributed to the impact of past sewage disposal practices and the resultant increased sediment oxygen demand (USACE 2008). This is not expected to happen in the proposed Port area because it is relatively distant from sewage disposal areas. Historical sewage discharge was from the "12-mile" site located approximately 11.4 nautical miles northwest of the proposed Port. The current sewage discharge locations are located 15.8 to 27.1 nautical miles away.

Turbidity

Fine grained material in the form of silt and clay suspended in the water column is referred to as turbidity and measured as total suspended solids (TSS) in mg/L. TSS can affect an ecosystem by transporting potential pollutants, decreasing oxygen levels and through direct impacts of settling and smothering the sea bottom.

The "Hudson River Plume" or turbid fresh water discharging into the New York Harbor from the Hudson River can often be seen in satellite imagery. The plume tends to exit the harbor in the vicinity of Sandy

Hook (Schofield et al. 2006) and extends southward along the New Jersey shore. The magnitude and extent of the plume is at a maximum during the spring months when flow from the river is greatest and on the ebb tide cycles. USACE sampling (2008) has shown that turbidity tends to exist across the full water column, with a maximum concentration at mid-depth, reflecting the buoyancy of the less saline Hudson River Plume over deeper, more saline bottom waters.

The proposed Port is located approximately 12.2 nautical miles to the east of the Hudson Canyon. Portions of the plume can extend further to the east, to the Hudson Canyon, and has the potential to extend into the general vicinity of the proposed Port facilities. However, modeling studies in the area of the Hudson Canyon (Chant et al. 2008) indicate there would be little to no effect from the plume in the area of the proposed Port. Therefore, it is expected that turbidity in the area of the proposed Port is relatively low.

No background sampling of turbidity was performed by the Applicant. However, modeling of proposed construction and operational activities on sediment dispersion and deposition assume a background turbidity of 0 mg/L along the proposed Port and Mainline route. The sediment dispersion modeling was based on the Advanced Circulation hydrodynamic model of the New York Bight. This modeling, which incorporates and accounts for width/length and depth of the proposed construction activities, along with sediment type and the direction of bottom currents, may be found in Appendix I. While there is no standard for TSS, a value of 50 mg/L for an extended duration was considered as a potential impact.

Trace Elements

Trace element concentrations at any particular time in the New York Bight are linked to the amount of discharge from the Hudson River Plume. There is no known water quality data in the vicinity of the proposed Port facilities or along the proposed Mainline route. However, the USACE Dredged Material Management Plan (DMMP) for the Port of New York and New Jersey (USACE 2008) has a detailed summary of data collected over a 40-year period spanning the 1960s to 1990s. In general, this summary indicates that seawater metals concentrations were greatest at the mouth of the New York Harbor and decreased offshore in the open New York Bight. Therefore, water quality related to trace element concentrations is considered better in the area of the proposed Port and Mainline route than at other near shore locations in the New York Bight. In addition, surface water concentrations are typically higher than those observed in bottom waters, reflecting the buoyancy of the less saline Hudson River Plume.

Iron concentrations, as reported by the USACE (2008), are typically higher than those found in the open ocean and vary seasonally. Average water surface iron concentrations were highest during the winter (ranging from 160 to 299 micrograms per liter [µg/L]) and lower (40 µg/L) the remainder of the year, although a second peak tended to occur during April, due to spring runoff. Manganese concentrations also vary seasonally; surface concentrations ranged from less than 1 µg/L in February up to 28 µg/L in April, clearly associated with sediment transport from the Hudson River. Stratification was apparent in April, when the surface concentration was 28 µg/L, and the bottom concentration was 10 µg/L. Copper concentrations ranged from 3.5 to 4.7 µg/L in the surface waters and generally in the range of 3 to 4 µg/L in the bottom waters, with a high value of 8 µg/L observed in the bottom waters in the month of July. Cadmium concentrations also vary seasonally and with depth. A maximum surface concentration of 8.9 µg/L was observed in February, with lesser values (0.5 to 1.5 µg/L range) observed other times of the year. Zinc concentrations range from 20 to 40 µg/L at the surface with relatively consistent concentrations vertically, although in the summer bottom concentrations were 10 to 20 µg/L less than surface concentrations. All of these trace element values are slightly above those found in the open ocean.

PCBs, Dioxins, and Furans

The NYSDEC New York/New Jersey Harbor Contamination Assessment and Reduction Project (Litten 2003) has performed water quality and sediment sampling in the New York area. Concentrations of polychlorinated biphenyls (PCBs), dioxins, and furan vary within the New York Bight, based on the magnitude and areal extent of the Hudson River Plume in a given area. Two locations were sampled in the New York Bight to serve as "clean ambient" background stations at the NOAA Ambrose Light Buoy and NOAA NDBC Buoy No. 44025. The average total PCB concentration observed in the New York Bight was 0.0732 nanograms per liter (ng/L). The dioxin-furan toxic equivalent concentration for a sample collected within the New York Bight was 0.0069 picograms per liter (pg/L).

Nutrients

The nutrient flux (phosphorous and nitrogen) contained within the Hudson River Plume is the primary source of nutrients in the New York Bight Apex (Stoddard et al. 1986). These nutrients contribute to the growth of phytoplankton in marine waters. In general, nutrient concentrations in bottom waters are higher than those in surface layers. Inshore waters undergo relatively larger changes in concentrations than bottom waters over the eastern extent of the shelf, which tend to remain high year-round. Slope waters rich in nutrients are a reservoir of nitrogen, which can replace nitrogen utilized on and/or lost from inshore waters. Cross shelf transport of this water, upwelling, and estuarine discharge can be influential in determining the distribution of a specific nutrient species at a given place and time with resultant effects on productivity and energy transfers to higher trophic levels (Matte and Waldhauer 1984).

Phosphorous concentrations sampled by the USACE (2008) from 1949 to 1974 indicated that mean inorganic phosphorus concentrations ranged from 0.012 to 0.025 mg/L at the surface and from 0.026 to 0.030 mg/L at the bottom. Monthly variations show a decreasing trend in inorganic phosphorus from about 0.028 mg/L in January to a minimum of about 0.018 mg/L in May. During the spring algal bloom, an increase in mean values from approximately 0.02 to 0.04 mg/L occurs.

Nitrogen data for the New York Bight (presented as nitrate nitrogen) indicate that peak concentrations (approximately 11 mg/L) are observed in April, due to increased flow in the Hudson River. During the remainder of the year, nitrate levels are lower, ranging from a mean level of approximately 0.06 mg/L in February to 0.008 mg/L in July. There is a tendency for higher nitrogen concentrations to extend southward along the shore, in the general direction of the Hudson River Plume (USACE 2008).

Nutrient loadings to the New York Bight have decreased over the past 20 years, resulting in improved overall water quality (Interagency Working Group 2010).

3.2 Biological Resources

The biological resources within the ROI are characteristic of an offshore marine environment. The proposed Project would be in the New York Bight, in the northwest Atlantic Ocean. This area is part of the larger U.S. EEZ, which extends from 3 to 200 nautical miles offshore. The ROI includes the proposed Port location, as well as the proposed Mainline route that would connect to an existing pipeline near shore. Therefore, the biological life within both the bottom substrate and the water column of the ROI may be impacted by the proposed Project. Proposed Project alternatives are located within the same general vicinity as the proposed Project location, and the affected area would be similar for all locations.

Biological resources evaluated include protected or sensitive species and habitats such as marine protected areas (MPAs), benthic communities, marine mammals, sea turtles, birds, plankton, fisheries resources, and federally listed threatened or endangered species. Fisheries resources include fish, federally managed commercial and recreational fisheries, and essential fish habitat (EFH). Determining which habitats and species occur in the ROI was accomplished through literature reviews, government documents, and project technical reports.

3.2.1 Benthic Resources

The portion of the New York Bight where the proposed Project is located consists of relatively flat topography, primarily composed of soft sediments. Substrate conditions within the vicinity of the proposed Project were initially assessed using the Marine Cadastre Viewer (NOAA and BOEM 2013), as well as The Nature Conservancy's Benthic Habitat Model (Greene et al. 2010), which both suggested that the portion of the continental shelf where the proposed Project is located is predominately sand – confirmed by site-specific data as 97 percent sand (AECOM 2012). Benthic habitats are characterized by physical or structural features, such as topography, substrate type, sediment grain size, and water depth, and by the presence of emergent biogenic structures (i.e., structures formed by plants or animals), such as coral reefs, mussel beds, and tube assemblages (Tyrell 2005; NER EFH SC 2002).

Benthic—or bottom—communities are composed of both substrate (habitat) and organisms that occupy that substrate. In soft-bottom areas, the structural foundation of sand and mud might be enhanced by sand waves or shell aggregations created by physical processes, or by tube assemblages, burrows, or depressions created by plants or animals (Lindholm et al. 1998). Soft-bottom (sand and mud) habitats contain both an epifaunal and infaunal assemblage; whereas hard-bottom habitats typically contain only an epifaunal assemblage. Benthic communities are further defined by population characteristics, such as species abundance, composition, and diversity. Benthic organisms play an important role in marine food web production. Deep sea coral and sponges have not been documented within the ROI (NYDOS 2013).

Sandy sediments within the ROI support a diverse fauna dominated by polychaete species and, to a lesser extent, mollusks and arthropods. Marine benthic organism distribution in the New York Bight is influenced by habitat, as well as physical and chemical characteristics of the water (e.g., depth, temperature, salinity, nutrient concentrations, and ocean currents as detailed in Section 3.1) (Levinton 2009). The higher number of species (diversity) and abundance of marine invertebrates in coastal water habitats, relative to the open ocean, is a result of the food and protection that coastal water habitats provide (Levinton 2009). The diversity and abundance of Arthropoda (e.g., crabs, lobsters, and barnacles) and Mollusca (e.g., snails and clams) are highest on the seafloor over the continental shelf (compared with the abyssal plain) due to high productivity and complex habitats relative to typical soft-bottom habitat of the deep ocean (Karleskint et al. 2006). These benthic invertebrates are important in the marine food web as prey for many higher organisms (e.g., fish and whales), as scavengers and recyclers of nutrients, and as habitat-forming organisms. Table 3.2-1 includes the benthic infaunal organism groups commonly found in sand-bottom habitat in the New York Bight.

Table 3.2-1. Common Marine Benthic Organisms within Coastal New York Waters

Common Name (Taxonomic Group)	Description
Flatworms (Phylum Platyhelminthes)	Mostly bottom-dwelling; simplest form of marine worm with a flattened body.
Hydroids and corals (Phylum Cnidaria)	Bottom-dwelling animals either habitat-forming or attached to other substrates.
Ribbon worms (Phylum Nemertea)	Bottom-dwelling marine worms with a long extension from the mouth (proboscis) that helps capture food.
Segmented worms (Phylum Annelida)	Mostly bottom-dwelling, highly mobile marine worms; many tube-dwelling species. Includes polychaetes and oligochaetes.
Peanut worms (Phylum Sipuncula)	Named for their similarity in shape to shelled peanuts. Primarily occur in shallow waters. While some burrow into sand and mud, others live in crevices in rocks or in empty shells.

Common Name (Taxonomic Group)	Description
Squid, bivalves, clams, quahog, sea snails, chitons, conchs (Phylum Mollusca)	Mollusks are a diverse group of soft-bodied invertebrates with a specialized layer of tissue called a mantle. Mollusks such as squid are active swimmers and predators, while others such as sea snails are predators or grazers; clams may be filter feeders or deposit feeders.
Shrimp, crab, lobster, barnacles, copepods (Phylum Arthropoda)	Bottom-dwelling or pelagic; some are immobile; with an external skeleton; all feeding modes from predator to filter feeder.
Sea stars, sea urchins, sea cucumbers (Phylum Echinodermata)	Bottom-dwelling predators and filter feeders with tube feet.
Horseshoe worms, lamp shells, moss animals (Phylum Lophophorata)	Sessile suspension feeders enclosed in secreted exoskeleton, shell, or tube. Have a common ring of ciliated, hollow tentacles called a lophophore, used for feeding, defense, and respiration.
Chordates (Phylum Chordata)	Chordates include both vertebrates and invertebrates. All chordates have a number of structures in common, including a notochord; a dorsal, hollow, ectodermal nerve cord; pharyngeal slits; and a post-anal tail. Only non-vertebrate chordates are discussed in this report.
Acorn worms (Phylum Hemichordata)	Generally live in burrows and are deposit feeders, but some species are pharyngeal filter feeders.
Sources: Appeltans et al. 2010; Bisby et al. 2010.	

In 2012, the Applicant performed a Benthic Resource Characterization Survey as part of their application (see Docket USCG-2013-0363) to assess both the physical and biological characteristics of benthic communities in the ROI. Grab samples were collected at 33 stations, including nine in the area of the proposed Port facilities and 24 along the proposed Mainline route, at water depths ranging from 43 to 112 feet. A total of 26,465 organisms were found, with 26,205 specimens identified to the species level, yielding 161 valid taxa in eight phyla (see Table 3.2-2). The dominant species were largely mobile predators, grazers, or burrowers. Among the smaller infauna, the polychaete *Polygoridius jouinae* was the overall dominant species; among the larger taxa, the common sand dollar, *Echinarachnius parma*, was most abundant.

As part of the 2012 survey, sediment profile image (SPI) samples were collected at 47 stations with a Hulcher sediment profile camera. Overall, the data set showed the presence of compacted, rippled fine to medium sands over the entire ROI, and all stations showed the presence of active bedforms superimposed on larger scale sand waves. Particulate organic matter was very low in these well-washed sediments (most total organic carbon values were less than 0.10 percent). According to the survey report, the combination of low particulate organic matter and bottom instability has limited the development of the benthic infauna, resulting in low-density populations of polychaetes.

Table 3.2-2. Observed Benthic Invertebrate Organisms in the ROI

Taxa	Total Number	Percent Abundance
Polygordius jouinae (P)	18,514	76.3%
Amastigos caperatus (P)	1,317	5.4%
Tanaissus psammophilus (T)	731	3.0%
Tubificoides diazi (O)	470	1.9%
Mediomastus ambiseta (P)	469	1.9%
Caulleriella venefica (P)	447	1.8%
Tharyx sp. A (P)	284	1.2%

Taxa	Total Number	Percent Abundance
Aricidea wassi (P)	229	0.9%
Parougia caeca (P)	214	0.9%
Angulus agilis (B)	213	0.9%
Tubificoides apectinatus(O)	204	0.8%
Echinarachnius parma (E)	191	0.8%
Aricidea catherinae (P)	180	0.7%
Sabellaria vulgaris (P)	166	0.7%
Rhepoxynius hudsoni (A)	154	0.6%
Nephtys picta (P)	126	0.5%
Phallodrilus coeloprostatus(O)	126	0.5%
Spisula solidissima (B)	114	0.5%
Monticellina baptisteae (P)	113	0.5%
A-Amphipoda, B-Bivalvia, E-Echinodermata, O-Oligochaeta, P-Polychaeta, T-Tanaidacea.		

3.2.2 Plankton

Plankton resources in the ocean include phytoplankton, zooplankton, diatoms, and ichthyoplankton. Plankton provide the base of the marine food web, with phytoplankton and diatoms representing the most basic of primary producers in the ocean. Many different types of zooplankton feed on phytoplankton and diatoms (and on other zooplankton), which are subsequently preyed on by consumers of all sizes ranging from small pelagic fish and invertebrates to large baleen whales.

Diatoms and dinoflagellates are the most common type of phytoplankton in the New York Bight. Some types of plankton undergo periodic "blooms" during which optimal growing conditions result in rapid growth and reproductive rates. Large concentrations of dinoflagellates can create "red" or "brown" tides, causing an increase in biological oxygen demand in a concentrated area. Occasionally, oxygen depletion becomes so severe that it results in large-scale mortalities of fish and shellfish. Phytoplankton blooms are often exacerbated by nutrient runoff within estuaries.

In general, nutrient concentrations in bottom waters are higher than those in surface layers. Inshore waters undergo relatively larger changes in concentrations than bottom waters over the eastern extent of the shelf, which tend to remain high year-round. Slope waters rich in nutrients are a reservoir of nitrogen, which can replace nitrogen utilized on and/or lost from inshore waters. Cross shelf transport of this water, upwelling, and estuarine discharge can be influential in determining the distribution of a specific nutrient species at a given place and time with resultant effects to productivity and energy transfers to higher trophic levels (Matte and Waldhauer 1984). Fisheries production is ultimately dependent on phytoplankton productivity, which is largely controlled by the availability of nutrients (nitrogen, phosphorus, and silicon), light, and temperature. The interaction of these three elements on the continental shelf of the Northwest Atlantic results in one of the most productive ecosystems in the world (O'Reilly and Busch 1982).

Phytoplankton primary productivity was empirically studied and theoretically modeled utilizing SeaWiFS chlorophyll concentrations by Mouw and Yoder (2005). This study concluded that for the Mid Atlantic Bight, phytoplankton concentrations estimated through satellite data only underestimated production from approximately 21 to 45 percent. In general for this area, primary production peaks in the March-April time frame with a low in summer months (July-August) then increases from this low through September-

February to peak again the following March-April. In the New York Bight, phytoplankton abundance follows this seasonal fluctuation, with a large-scale bloom occurring during the spring when increased solar radiation combined with increased water temperatures and nutrient availability create favorable conditions for a bloom. Another bloom may occur during the fall when the stratified water column of the summer becomes mixed and nutrients from deep water are transferred to the photic zone. During such blooms, phytoplankton densities may exceed a range of 10,000 to 1,000,000 organisms per liter (37,900 to 3,790,000 organisms per gallon) of seawater in offshore areas, and even higher in nearshore areas (USFWS 1997). Phytoplankton abundance is often highest closer to shore, decreasing offshore, in correlation with nutrient levels (NYDOS 2013).

Common organisms that comprise the zooplankton within the New York Bight include copepods, amphipods, and early lifestages of many other invertebrate and vertebrate species, including decapod crabs, shrimp, lobster, fish (ichthyoplankton), gastropods, bivalves, and mollusks. Copepods are typically the dominant species in terms of biomass throughout the year, but similar to phytoplankton blooms, zooplankton blooms can also occur for various species. Such blooms often follow a phytoplankton or diatom bloom, which are consumed by zooplankton, particularly copepods. In the New York Bight, typical copepod abundance can range from 200 to 8,000 individuals per cubic meter (6 to 227 individuals per cubic foot) in the offshore portions of the New York Bight, with greater abundances closer to shore (USFWS 1997). Ichthyoplankton becomes more abundant during the summer months as many species spawn during this time, particularly the abundant and prolific bay anchovy. In nearshore areas of New York Bay, bay anchovy eggs represent a dominant proportion of the total ichthyoplankton abundance.

3.2.3 Fisheries Resources

This section focuses on the fish resources that occur within the ROI. The only species listed under the Endangered Species Act (ESA), the Atlantic sturgeon, is further discussed in Section 3.3.1. Federally managed fisheries and EFH species are addressed in Section 3.4 and Appendix E.

There are more than 100 marine fish species in the New York Bight, approximately two-thirds of which occur in the coastal zone (Froese and Pauly 2010). Marine fish can be broadly categorized into horizontal and vertical distributions. The primary ecological groups of fish that occur in the marine environment within the New York Bight include the hard-bottom/structure community, the seafloor community, and the pelagic community (Schwartz 1989). The highest number and diversity of fish typically occur where there is greatest habitat variability, including physical variety (hard structure, continental slopes, deep canyons, currents, temperature), biological productivity (areas of nutrient upwelling), and chemical factors (water chemistry, water quality) (Bergstad et al. 2008; Helfman et al. 1997; Moyle and Cech 1996; Parin 1984; Reshetiloff 2004). Additionally, some of the marine fish that occur within the coastal zone exhibit diadromous life history patterns, moving between marine and freshwater systems (Helfman et al. 1997). Other distribution factors, including predator/prey relationships, water quality, and cover (e.g., physical structure or vegetation cover), operate on more regional or localized spatial scales (Reshetiloff 2004). Also, the habitats that marine fish utilize may vary through time, as well as lifestage (Schwartz 1989).

Groups of marine fish of the New York Bight are provided in Table 3.2-3. These fish groups are based on the organization presented in Helfman et al. (2009), Moyle and Cech (1996), and Nelson (2006) and variability within each group exists (e.g., ecological niches, behavioral characteristics, and habitat preferences). Species that have similar diets can also be characterized as part of feeding (or ecological) guilds. Following the introduction of individual taxa, species or groups within the ROI are organized into ecological guilds at the end of this section.

Table 3.2-3. Major Groups of Marine Fish in the ROI

Major Marine Fish Group Names	Vertical Distribution within the ROI
Jawless Fish (Order Myxiniformes and Order Petromyzontiformes)	Seafloor
Sharks, Skates, Rays, and Chimaeras (Class Chondrichthyes)	Surface, water column, seafloor
Sturgeons and Gars (Order Acipenseriformes and Order Lepisosteiformes)	Surface (occasional), water column, seafloor
Eels and Bonefish (Order Anguilliformes and Order Elopiformes)	Surface, water column, seafloor
Herrings (Order Clupeiformes)	Surface, water column
Cods and Cusk-Eels (Orders Gadiformes and Ophidiiformes)	Water column, seafloor
Toadfish and Anglerfish (Orders Batrachoidiformes and Lophiiformes)	Seafloor
Pipefish and Seahorses (Order Gasterosteiformes)	Surface, water column, seafloor
Scorpionfish (Order Scorpaeniformes)	Seafloor
Drums, Snappers, Temperate Basses, and Reef Fish (Order Perciformes, with Representative Families; Sciaenidae, Lutjanidae, Moronidae, Pomacanthidae, and Mullidae)	Surface, water column, seafloor
Sea Basses (Order Perciformes, with Representative Families; Serranidae)	Surface, water column, seafloor
Wrasses (Order Perciformes, with Representative Families; Labridae)	Surface, water column, seafloor
Gobies, Blennies, and Damselfish (Order Perciformes, with Representative Suborders: Gobioidei, Blennioidei, and Acanthuroidei)	Seafloor
Jacks, Tunas, Mackerels, and Billfish (Order Perciformes, with Representative Families: Carangidae, Scombridae, Xiphiidae, and Istiophoridae)	Surface, water column
Flounders (Order Pleuronectiformes)	Seafloor
Triggerfish and Puffers (Order Tetraodontiformes)	Surface, water column, seafloor

Hagfish and Lampreys (Orders Myxiniformes and Petromyzontiformes)

Hagfish (Order Myxiniformes) and lampreys (Order Petromyzontiformes) occur in the seafloor habitats of all open ocean areas and coastal waters of the ROI (Paxton and Eshmeyer 1998). Hagfish are typically found at depths greater than 80 feet and temperatures below 55°F (13°C). This group has very limited external features characteristic of many fish (e.g., fins, scales). Hagfish scavenge on dead and dying fish of the ocean floor (Helfman et al. 1997), providing an important ecosystem service of recycling nutrients. Sea lamprey (*Petromyzon marinus*) migrate between freshwater rivers and marine waters. The lampreys are typically parasitic feeders and prey on other fish (Moyle and Cech 1996; Nelson 2006).

Sharks, Skates, and Rays (Subclass Elasmobranchii)

Many species within this group of elasmobranchs are highly migratory and are managed by a NOAA Fisheries Fishery Management Plan (FMP) (NMFS 2009a)—refer to Section 3.4 for a complete list of managed species. This group is mainly predatory and contains many of the apex predators found in the ocean (e.g., great white shark [*Carcharodon carcharias*], mako shark [*Isurus oxyrinchus*], and tiger shark [*Galeocerdo cuvier*]) (Helfman et al. 1997). Chondrichthyians also exhibit some unique biological features pertaining to buoyancy (no swim bladder), dermal protection (placoid, tooth-like scales), sensory systems (electroreception, mechanoreception), reproduction (live birth), and overall life history (Moyle and Cech 1996). Most marine elasmobranchs occupy relatively shallow temperate and tropical waters throughout the world. More than half of these species occur in less than 655 feet of water, and nearly all are found at depths less than 6,560 feet (Nelson 2006).

Sturgeons (Order Acipenseriformes)

The sturgeons (Order Acipenseriformes) are among the most primitive orders of fish (Nelson 2006). The Atlantic sturgeon (*Acipenser oxyrhynchus*; see Section 3.3.1) and shortnose sturgeon (*Acipenser brevirostrum*) both occur within the New York Bight and migrate between freshwater and saltwater. Adult shortnose sturgeon are found in deep water (35 to 100 feet) in winter and in shallow water (7 to 35 feet) during summer (Welsh et al. 2002). Individual shortnose sturgeon do not disperse far along the coastline beyond their home river estuaries (NMFS 1998). Atlantic sturgeon migrate back into estuarine and marine waters after spawning. Tagging data indicate that immature Atlantic sturgeon disperse widely once they move into coastal waters (Secor et al. 2000). Dispersal is extensive: north and south along the Atlantic coast and seaward to the edge of the continental shelf (Bain 1997). In the United States, Atlantic sturgeon can occur as far north as the St. Croix River in Maine, and as far south as the St. Johns River in Florida. Atlantic sturgeon juveniles may occur in salinities ranging from 5 to 25 practical salinity units (psu) in estuaries, usually over a mud-sand bottom (Dadswell 2006). Subadults and adults live in coastal waters and estuaries when not spawning, generally in shallow (35 to 165 feet) inshore areas of the continental shelf where they feed (FR 75 (3): 838-841, January 6, 2010).

Eels, Bonefish, and Herrings (Superorders Elopomorpha and Clupeomorpha)

The American eel (*Anguilla rostrata*) is catadromous, meaning it is born in saltwater then migrates into freshwater to mature (Jessop et al. 2002), although evidence suggests that some populations never migrate into freshwater and inhabit only estuarine and brackish water (Arai and Chino 2012). Spawning of the U.S. population of American eel is believed to occur in the Sargasso Sea of the Atlantic Ocean. From there, eggs, larvae, and juveniles are dispersed via the Gulf Stream and other oceanic currents, feeding at the ocean surface. As juveniles, or “glass eels,” they enter coastal waters where they further mature into ‘‘elvers’’ and then a late juvenile stage known as ‘‘yellow eels” (USFWS 2011). Older juveniles and adults occupy estuarine and freshwater habitats, often swimming far upriver into lakes, ponds, and headwater streams, where they may spend up to 30 years as adults. Mature adults, or “silver eels,” migrate to the Sargasso Sea to spawn and die (USFWS 2011).

Clupeiformes, which include herring, menhaden, sardine, and anchovy species, are sometimes anadromous and are one of the most well-defined orders (taxonomically) of fish because of their importance to commercial fisheries (Nelson 2006). They are often concentrated in large aggregations or schools within coastal waters, as well as offshore (Brehmer et al. 2007). Clupeids are an important part of marine food webs because they are the targeted prey species for many other marine species, including other fish, birds, and mammals. Both juvenile and adult Atlantic herring (*Clupea harengus*) occur in higher densities in the spring in the ROI; they have little to no presence in the fall (NYDOS 2013). River herring typically occur over the continental shelf in waters less than 328 feet (Neves 1981). River herring range from Newfoundland to North Carolina (alewife, *Alosa pseudoharengus*) (NMFS 2009c) and south to the St. Johns River, Florida (blueback herring, *Alosa aestivalis*) (McBride et al. 2010). River herring are anadromous, migrating during the spring months to spawn in their natal rivers on the East Coast then returning to coastal waters in the summer.

Cods (Order Gadiformes)

The cods (Order Gadiformes) or “groundfish” account for approximately one-half of the world’s commercial fishery landings (Food and Agriculture Organization of the United Nations 2005). Gadiformes are almost exclusively marine fish and occupy benthic habitats in temperate, arctic, and Antarctic regions. Atlantic cod (*Gadus morhua*), one of the most sought-after commercial fish in Order Gadiformes, have been collected in waters from Canada to the Chesapeake Bay, but they are more common north of Cape Cod (Lough 2004). Cods are generally found near the bottom and feed on benthic resources.

Toadfish and Anglerfish (Orders Batrachoidiformes and Lophiiformes)

Toadfish (Order Batrachoidiformes) occur in coastal seafloor habitats throughout the New York Bight. Anglerfish (Order Lophiiformes) are also found in seafloor habitats, but across a deeper range throughout the ROI (Froese and Pauly 2010). Highly modified photophores, typically referred to as "lures," are used by these fish to attract prey (Helfman et al. 1997; Koslow 1996). Some of the anglerfish, such as the monkfish (*Lophius americanus*), support an important commercial fishery (NEFMC and MAFMC 2006). This species is also an important predator among the deep water bottom habitat areas of the ROI (Nelson 2006). The Order Batrachoidiformes includes only one family, the toadfish family. The distribution of this group is limited to coastal benthic marine environments within the Atlantic, Indian, and Pacific oceans. A common example of toadfish is the oyster toadfish (*Opsanus tau*), which is common within the shallow estuarine areas of the New York Bight. Toadfish are capable of producing (and detecting) sounds by vibrating the swim bladder.

Pipefish and Seahorses (Order Gasterosteiformes)

Fish of the Order Gasterosteiformes include the sticklebacks, pipefish, and seahorses; all common within the ROI. Most of these species are found in brackish water throughout the world (Nelson 2006). Small mouths on a long snout and armor-like scales are characteristic of this group. Most of these species exhibit a high-level of parental care, either through nest-building (sticklebacks) or brood pouches (seahorses) (Helfman et al. 1997). Parental care such as this is an energetically costly life history strategy, resulting in very few young produced per spawning event (Helfman et al. 1997).

Scorpaenids (Order Scorpaeniformes)

Most species of the Order Scorpaeniformes are distributed in marine benthic habitats at depths less than 330 feet and possess adaptations for inhabiting the dominant bottom substrate (e.g., modified pectoral fins, suction discs), where they feed on smaller crustaceans and fish. These bottom-dwelling fish include searobins, gurnards, sculpins, lumpfish, and snailfish; all are characterized by adaptations for inhabiting the dominant bottom substrate. Searobins are capable of generating sounds with their swim bladder and are among the "noisiest" of all fish species within the ROI (Moyle and Cech 1996). Lumpfish have a box-shape body form and are typically found attached to the seafloor. They are also a preferred prey species of sperm whales, seals, and some shark species (Moyle and Cech 1996).

Drums and Temperate Basses (Families Sciaenidae and Moronidae)

These fish sometimes move in schools as juveniles, and then become more solitary as they grow larger. They primarily feed on fish and crustaceans. Drums and croakers (Family Sciaenidae) produce drumming sounds via their swim bladders and, like the searobin, are among the noisiest of all fish species in the ROI. The temperate basses are among the most popular saltwater gamefish of recreational anglers, occurring most often in nearshore coastal waters. Striped bass (*Morone saxatilis*) are the most sought-after recreational species of all temperate basses, particularly in the New York Bight. Striped bass are distributed throughout coastal environments (Paxton and Eshmeyer 1998) and concentrate in depths of less than 330 feet (Froese and Pauly 2010).

Sea Basses (Family Serranidae)

Black sea bass (*Centropristis striata*) are found in the coastal and offshore reef and hard-bottom habitats of the ROI (Burge et al. 2012). They feed mostly on bottom-dwelling fish and crustaceans (Goatley and Bellwood 2009). Serranids are especially active foragers at twilight (Rickel and Genin 2005), while other fish are active during the day (Wainwright and Richard 1995). Some of the serranids (such as the black sea bass) are protogynous hermaphrodites, beginning life as female and then becoming male as they grow larger (Moyle and Cech 1996). Their slow maturation makes them vulnerable to overharvest (IUCN 2009). Black sea bass occur more in the fall rather than the spring within the ROI (NYDOS 2013).

Wrasses (Family Labridae)

The most common members of this family within the New York Bight are tautog (*Tautoga onitis*) and cunner (*Tautogolabrus adspersus*). They are active during daytime and exhibit a variety of opportunistic predatory strategies to capitalize on mistakes made by prey species (Wainwright and Richard 1995). Similar to the Serranidae, many wrasses are hermaphroditic (small individuals are female and then some become male as they grow larger), with a variety of reproductive strategies found among the species and between populations (Moyle and Cech 1996).

Gobies and Blennies (Families Gobiidae and Blenniidae)

Fish of the suborder Blennioidei primarily occupy the intertidal zones throughout the world, including the clinid blennies and the combtooth blennies of the family Blenniidae (Mahon et al. 1998; Moyle and Cech 1996; Nelson 2006). The bottom-dwelling gobies (suborder Gobiodei) include Gobiidae, the largest family of marine fish in the world (Nelson 2006), and exhibit modified pelvic fins that allow them to adhere to various substrates (Helfman et al. 1997). The blennies and gobies primarily feed on detritus found on bottom surfaces.

Jacks, Tunas, Mackerels, and Billfish (Families Scombridae, Xiphiidae, and Istiophoridae)

The suborder Scombroidei contains some of the most voracious open-ocean predators other than sharks: the jacks, mackerels, barracudas, billfish, and tunas (Estrada et al. 2003; Sibert et al. 2006). These fish are also among the fastest swimming marine fish. The highly migratory tunas, mackerels, and billfish constitute a large component of the total annual worldwide commercial fishing catch by weight, with tunas and swordfish being the highest economic importance (Food and Agriculture Organization of the United Nations 2005, 2009). Many fish in this group undertake large-scale migrations to follow a seasonally variable prey base (Pitcher 1995). The Atlantic bluefin tuna (*Thunnus thynnus*) is a NOAA Fisheries Species of Concern that occurs in the ROI. They are mostly found near the surface or in the upper portion of the water column, in all coastal waters and open ocean areas of the ROI.

Flounders (Order Pleuronectiformes)

The order Pleuronectiformes includes the laterally compressed flatfish (flounders, dabs, soles, and tonguefish) that are found in all marine bottom habitats (Nelson 2006). Flounders are a very important commercial and recreational group of fish throughout the northeastern United States (NEFMC 1998a,b,c,d), and particularly within the ROI (Moyle and Cech 1996). Summer flounder (*Paralichthys dentatus*), a valued recreational and commercial fish, is more common within the ROI during the fall, compared to spring (NYDOS 2013). For example, during 2008, total winter flounder (*Pseudopleuronectes americanus*) landings were approximately 2,900 tons (NMFS 2009b). All flounder species are lie-in-wait ambush predators, feeding mostly on other fish and benthic invertebrates (Drazen and Seibel 2007; Froese and Pauly 2010).

Puffers and Molas (Order Tetraodontiformes)

The Order Tetraodontiformes, including the triggerfish, filefish, puffers, and ocean sunfish, are the most highly evolved group of modern bony fish (Nelson 2006). Like the flounders, this group exhibits unusual body shapes with modified spines or other structures to deter predators. The bodies of some species are so boxlike that they cannot swim using the typical body propulsion style, but instead are propelled at slow speeds by rudimentary fins (Wainwright and Richard 1995). Ocean sunfish (*Mola mola*) are the largest bony fish (Moyle and Cech 1996) and live very close to the surface, where they feed on a variety of plankton, jellyfish, crustaceans, and fish (Froese and Pauly 2010).

Ecological Guilds

Species with similar diets can be grouped into ecological guilds (Auster and Link 2009). To identify trophic guilds within the ROI, the effect of commercial fishing on community structure at the site, known depth of predatory species, and the proposed location of the Project were considered. Out of the possible 14 guilds (Garrison and Link 2000), six were identified for further consideration of proposed Project impacts. The six ecological guilds within the ROI are crab eaters, planktivores, amphipod/shrimp eaters, shrimp/small fish eaters, benthivores, and piscivores. Inclusion into each guild often changes over the life of a fish, as the animal grows. Depending on the species, the following size descriptions have been applied: small (3.9-15.7 inches); medium (8.3-27.6 inches); large (20.1-31.5 inches); and extra-large (>31.5 inches). Here, the groups are summarized based on diet preferences, with fish representative of each guild (Table 3.2-4); detailed analysis of trophic fish guilds and additional representative species can be found in Appendix F.

These six ecological guilds, grouped by similarity in prey items, are found within the ROI and may be impacted by the proposed Project. Impacts specific to these guilds are discussed further in Appendix F and are summarized in Section 4.2.4.

Table 3.2-4. Ecological Guilds within the ROI

Ecological Guild	Diet	Representative Species
Crab-eaters	Crab species (family Cancridae), zooplankton, bivalves	Small and medium smooth dogfish (*Mustelus canis)*; medium black sea bass (*Centropristis striata*)
Planktivores	Zooplankton, euphausiids, shrimp, cephlapods, fish	Small spiny dogfish (*Squalus acanthias*), Atlantic herring (*Clupea harengus*), Atlantic butterfish *(Peprilus triancanthus*); medium spiny dogfish, Atlantic herring, alewife (*Alosa pseudoharengus*); large longfin squid (*Loligo pealei)*
Amphipod/shrimp eaters	Amphipods, shrimp, crabs, zooplankton, polychaetes, fish	Small winter and little skates (*Leucoraja* spp.), red hake (*Urophycis chuss*), windowpane flounder (*Scophthalmus aquosus*); medium winter and little skates, Atlantic cod *(Gadus morhua*); large cusk eel (*Lepophidium profundorum)*
Shrimp/small fish eaters	Shrimp (various taxa), euphausiids, small fish	Small pollock (*Pollachius virens*), silver hake (*Merluccius bilinearis*); medium silver hake, white hake *(Urophycis tenuis)*, pollock; large red hake, pollock; extra-large pollock
Benthivores	Polychaetes, echinoderms, ophiuroids	Small haddock (*Melanogrammus aeglefinus*), winter flounder (*Psudopleuronectes americanus*), Atlantic croaker (*Micropogon undulatus*); medium winter flounder, haddock, scup (*Stenotomus chrysops*); large yellowtail flounder (*Pleuronectus ferruginea*), winter flounder, haddock
Piscivores	Fish (including clupeids, scombrids, sand lance [*Ammodytes americanus*]), Engraulid anchovies, squid	Small bluefish (*Pomatomus saltatrix*), weakfish (*Cynoscion regalis*); medium bluefish, summer flounder (*Paralichthys dentatus*), weakfish; large spiny dogfish, Atlantic cod, summer flounder, shark (various taxa); Extra-large Atlantic cod, winter skate

3.2.4 Non-endangered Marine Mammals

Under the authority of the Marine Mammal Protection Act (MMPA) of 1972 (16 U.S.C. 1361 et seq.), the Secretary of Commerce is responsible for the protection of all marine mammals except walruses, polar bears, sea otters, manatees, and dugongs, which are the responsibility of the Secretary of the Interior. These responsibilities have been delegated to National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries) and the U.S. Fish and Wildlife Service (USFWS), respectively, and include providing overview and advice to regulatory agencies on all federal actions that might affect these species.

The MMPA prohibits the "take" of marine mammals, with certain exceptions, in waters under U.S. jurisdiction and by U.S. citizens on the high seas. Under Section 3 of the MMPA, "take" is defined as to "harass, hunt, capture, kill, or attempt to harass, hunt, capture, or kill any marine mammal." "Harassment" is defined as any act of pursuit, torment, or annoyance that has the potential to injure marine mammal stocks in the wild; or has the potential to disturb marine mammal stock in the wild by disrupting behavioral patterns, including migration, breathing, nursing, breeding, feeding, or sheltering. In cases where U.S. citizens are engaged in activities, other than fishing, that result in "unavoidable" incidental take of marine mammals, the Secretary of Commerce can issue a "small take authorization." The authorization can be issued after notice, with an opportunity for public comment if the Secretary of Commerce finds minor impacts.

The MMPA requires consultations with NOAA's Office of Protected Resources if an Applicant believes their activity would result in harassment of marine mammals. Under the MMPA, the Applicant would be responsible for acquiring either a letter of authorization (LOA) or Incidental Harassment Authorization (IHA), if deemed necessary. This draft Environmental Impact Statement (EIS) provides the necessary information to proceed with the MMPA consultation process. Non-listed marine mammal species present in the ROI and their likelihood of occurrence are found in Table 3.2-5. Federally listed marine mammal species are discussed in detail in Section 3.3.1.

Table 3.2-5. Marine Mammal Species in ROI

Common Name	Scientific Name	Occurrence in ROI	ESA/MMPA Status
Atlantic spotted dolphin	*Stenella frontalis*	Likely to be present	MMPA protected only
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Potentially transient	MMPA protected only
Bottlenose dolphin	*Tursiops truncatus*	Likely to be present	Strategic
Clymene dolphin	*Stenella clymene*	Not likely to be present	MMPA protected only
Cuvier's beaked whale	*Ziphius cavirostris*	Not likely to be present	MMPA protected only
Dwarf sperm whale	*Kogia sima*	Not likely to be present	MMPA protected only
False killer whale	*Pseudorca crassidens*	Not likely to be present	MMPA protected only
Gray seal	*Halichoerus grypus*	Likely to be present	MMPA protected only
Harbor porpoise	*Phocoena*	Likely to be present	MMPA protected only
Harbor seal	*Phoca vitulina*	Likely to be present	MMPA protected only
Harp seal	*Pagophilus groenlandicus*	Potentially transient	MMPA protected only
Hooded seal	*Cystophora cristata*	Potentially transient	MMPA protected only
Killer whale	*Orcinus orca*	Not likely to be present	MMPA protected only
Long-finned pilot whale	*Globicephala melas*	Not likely to be present	MMPA protected only
Melon-headed whale	*Peponocephala electra*	Not likely to be present	MMPA protected only
Mesoplodon beaked whale	*Mesoplodon Spp.*	Not likely to be present	MMPA protected only
Minke whale	*Balaenoptera acutorostrata*	Likely to be present	MMPA protected only
Pygmy killer whale	*Feresa attenuate*	Not likely to be present	MMPA protected only
Pygmy sperm whale	*Kogia breviceps*	Not likely to be present	Strategic
Risso's dolphin	*Grampus griseus*	Not likely to be present	MMPA protected only

Common Name	Scientific Name	Occurrence in ROI	ESA/MMPA Status
Short-beaked common dolphin	*Delphinus delphis*	Not likely to be present	MMPA protected only
Spinner dolphin	*Stenella longirostris*	Not likely to be present	MMPA protected only
Striped dolphin	*Stenella coeruleoalba*	Not likely to be present	MMPA protected only
White-beaked dolphin	*Lagenorhynchus albirostris*	Potentially transient	MMPA protected only

The marine mammals listed in Table 3.2-5 as "not likely to be present" are not discussed further. The focus here is on those likely to be present or transient within the ROI.

Bottlenose Dolphin *(Tursiops truncatus)*

Common bottlenose dolphins are found most often in coastal and continental shelf waters of tropical and temperate regions of the world. They occur in most enclosed or semi-enclosed seas. The species inhabits shallow, murky, estuarine waters and also deep, clear, offshore waters (Jefferson et al. 2008; Wells and Scott 2008). Common bottlenose dolphins are often found in bays, lagoons, channels, and river mouths. The common bottlenose dolphin ranges worldwide in tropical to temperate waters of the Atlantic, Pacific, and Indian oceans. Bottlenose dolphins are distributed in inshore, coastal, and offshore waters of the New York Bight (Jefferson et al. 2008; Wells and Scott 2008). This species is likely to be present within the ROI.

A secondary habitat for bottlenose dolphins is deep, offshore waters beyond the continental shelf edge (Jefferson et al. 2008; Wells and Scott 2008). They have the potential to occur at some level in all open ocean waters in the ROI; however, there is almost no specific information on their abundance and distribution in these areas. Although abundance is not estimated for all stocks that occur in U.S. waters, over 100,000 individuals are estimated to live in the U.S. Atlantic Ocean (Waring et al. 2013).

Minke Whale *(Balaenoptera acutorostrata)*

The minke whale is widespread and seasonally abundant in the North Atlantic Ocean. Minke whales generally occupy waters over the continental shelf, including inshore bays and an occasional estuaries. Minke whale habitat is linked to migration from breeding to feeding grounds, and also to prey availability (Ingram et al. 2007; Jefferson et al. 2008). Although these whales can occur offshore in some portions of the Gulf Stream and North Central Atlantic Gyre, minke whales are more often found in coastal and nearshore areas. In the North Atlantic, this species ranges from Davis Strait and Baffin Bay during the summer months, south to the Florida Keys and Gulf of Mexico in the winter. Minke whales are thought to undergo annual migrations between low latitude breeding grounds in the winter months and high latitude feeding grounds in the summer months (Kuker et al. 2005). They feed opportunistically on crustaceans (e.g., krill), plankton (e.g., copepods), and small schooling fish (e.g., anchovies, dogfish, capelin, coal fish, cod, eels, herring, mackerel, salmon, sandlance, saury, and wolffish) (NOAA/NMFS 2012b). Estimates indicate that there are more than 100,000 minke whales in the North Atlantic Ocean (Jefferson et al. 2008; Perrin and Brownell 2008; Skaug et al. 2004). This species is likely to be present within the ROI.

Atlantic White-Sided Dolphin *(Lagenorhynchus acutus)*

This species is found primarily in cold temperate to subpolar continental shelf waters to the 328.1-foot depth contour (Cetacean and Turtle Assessment Program 1982; Mate et al. 1994; Selzer and Payne 1988). Occurrence of Atlantic white-sided dolphins off the northeastern U.S. coast probably reflects fluctuations in food availability, as well as oceanographic conditions (Palka et al. 1997; Selzer and Payne 1988). Atlantic white-sided dolphins are common in waters of the continental slope from New England in the west and north to southern Greenland (Cipriano 2008; Jefferson et al. 2008). Along the Canadian and

U.S. Atlantic coast, this species is most common from Hudson Canyon north to the Gulf of Maine (Palka et al. 1997). This species is likely to be present within the ROI.

From June through September, large numbers of white-sided dolphins are found from Georges Bank to the lower Bay of Fundy (Payne et al. 1990; Waring et al. 2004). During this time, strandings occur from New Brunswick, Canada to New York (Palka et al. 1997). From October to December, white-sided dolphins occur at intermediate densities from southern Georges Bank to southern Gulf of Maine (Cetacean and Turtle Assessment Program 1982; Palka et al. 1997; Payne et al. 1990; Waring et al. 2004). They feed on fish (e.g., mackerel, herring, and hake), as well as squid and shrimp (NOAA/NMFS 2012b). This species is quite abundant throughout its range, with total numbers estimated to be in the hundreds of thousands. The total number of white-sided dolphins along the United States and Canadian Atlantic coasts is not completely known, but at least 27,200 have been estimated to occur from Virginia to the eastern Scotian Slope region (Palka et al. 1997).

Harbor Porpoise *(Phocoena phocoena)*

Harbor porpoises inhabit cool temperate-to-subpolar waters, often where prey aggregations are concentrated (Watts and Gaskin 1985). Thus, they are frequently found in shallow waters, most often nearshore, but they sometimes move into deeper, offshore waters. Harbor porpoise habitat varies by water depth, substrate type, and prey availability. Harbor porpoises are rarely found in waters warmer than 62.6°F (17°C) (Read 1999), and closely follow the movements of their primary prey, Atlantic herring (Gaskin 1992). Harbor porpoises are generally scarce in areas without significant coastal fronts or topographically generated upwellings (Gaskin 1992; Skov et al. 2003). Fine-scale oceanographic features (e.g., island and headland wakes) aggregate prey and are important feeding habitats for harbor porpoises (Johnston et al. 2005). Harbor porpoises occur most frequently over the continental shelf, although they occasionally stray to deeper, offshore waters (MacLeod et al. 2007; Read 1999). Nevertheless, individuals have been found offshore in water deeper than 5,905 feet, which indicates a potential offshore component to their distribution in the western North Atlantic Ocean (Read and Westgate 1997; Westgate and Read 1998). This species is likely to be present within the ROI.

A single stock of harbor porpoises is considered to inhabit the eastern seaboard of the United States and Canada, and the major area of occurrence for these animals in the summer is in the Gulf of Maine and Bay of Fundy (Waring et al. 2009). There is a well-established seasonal shift to the south of harbor porpoises in the western North Atlantic for the winter months (Read and Westgate 1997). In the ROI, highest densities appear to occur in the spring; abundances are less in summer and farther offshore in fall and winter (NYDOS 2013). Cumulatively, abundance estimates suggest the global abundance of the harbor porpoise is greater than 675,000 to 700,000 individuals (Gaskin et al. 1993; Jefferson et al. 2008).

Harbor Seal *(Phoca vitulina)*

Harbor seals, while primarily aquatic, also utilize the coastal terrestrial environment where they haul out of the water periodically. Harbor seals are a coastal species, rarely found more than 10.8 nautical miles from shore, and frequently occupying bays, estuaries, and inlets (Baird 2001). Individual seals have been observed several miles upstream in coastal rivers (Baird 2001). Haul-out locations vary but include intertidal and subtidal rock outcrops, sandbars, sandy beaches, and even peat banks in salt marshes (Burns 2008; Gilbert and Guldager 1998; Prescott 1982; Schneider and Payne 1983). Harbor seals occur in the cold and temperate nearshore waters of the Northwest Atlantic, typically above 30° N. Their distribution includes the Gulf of St. Lawrence, Scotian Shelf, Gulf of Maine, Bay of Fundy, and the Northeast U.S. Continental Shelf. Harbor seals are common year-round in the coastal waters of eastern Canada and Maine and occur from southern New England to New Jersey coasts during the winter months (September – May) (Katona et al. 1993; Waring et al. 2009). Harbor seals are not considered migratory (Burns 2008; Jefferson et al. 2008). The best estimate of abundance for the western North Atlantic stock of harbor seals is 99,340 individuals (Waring et al. 2009). The total population estimate of harbor seals is approximately

300,000–500,000 individuals (Burns 2008; Jefferson et al. 2008). This species is likely to be present within the ROI.

Gray Seal *(Halichoerus grypus)*

The gray seal is considered to be a coastal species (Lesage and Hammill 2001). Gray seals may forage far from shore, but do not appear to leave the continental shelf regions (Lesage and Hammill 2001). Gray seals haul out on ice, exposed reefs, or beaches of undisturbed islands (Lesage and Hammill 2001). The primary range of this species includes the northwestern waters of the Scotian Shelf and Northeast U.S. Continental Shelf. The gray seal is found throughout temperate and subarctic waters on both sides of the North Atlantic Ocean (Davies 1957; Hall and Thompson 2008). In the western North Atlantic Ocean, the gray seal population is centered in the Canadian Maritimes, including the Gulf of St. Lawrence and the Atlantic coasts of Nova Scotia, Newfoundland, and Labrador. The largest concentrations are found in the southern half of the Gulf of St. Lawrence (where most seals breed on ice), and around Sable Island (where most seals breed on land) in the Scotian Shelf Large Marine Ecosystem (Davies 1957; Hammill and Gosselin 1995; Hammill et al. 1998). Gray seals range south into the northeastern United States, with strandings as far south as North Carolina (Hammill et al. 1998; Waring et al. 2004). Small numbers of gray seals and pupping areas have been observed on several isolated islands along the central coast of Maine and in Nantucket Sound (Andrews and Mott 1967; Rough 1995; Waring et al. 2004). Current estimates of the total western Atlantic gray seal population are not available. This species is likely to be present within the ROI.

Harp Seal *(Pagophilus groenlandicus)*

The primary range of this species is throughout the Arctic; however, the secondary range includes the western waters of the Scotian Shelf and the Northeast U.S. Continental Shelf. Typically, harp seals are distributed on the pack ice of the North Atlantic segment of the Arctic Ocean, and through Newfoundland and the Gulf of St. Lawrence (Reeves et al. 2002). The number of sightings and strandings of harp seals off the northeastern United States has been increasing (Harris et al. 2002; McAlpine and Walker 1999; Stevick and Fernald 1998). These occurrences are usually during January through May (Harris et al. 2002), when the western North Atlantic stock of harp seals is at its most southern point in distribution (Waring et al. 2004). The large-scale movements of harp seals represent an annual round-trip of nearly 2,160 nautical miles, primarily between the Canadian Maritimes and the Arctic (Bowen and Siniff 1999). Data are insufficient to calculate a population estimate for U.S. waters (Waring et al. 2009). This species is likely to be transient through the ROI.

Atlantic Spotted Dolphin *(Stenella frontalis)*

The Atlantic spotted dolphin is found in nearshore tropical to warm-temperate waters. Atlantic spotted dolphins occur predominately over the continental shelf and upper slope. In the western Atlantic, this species is distributed from New England to Brazil (Perrin 2008). Upper continental slope waters beyond the shelf edge may be a secondary habitat for this species, which have been reported at depths of 656 to 7,218 feet (Best 2007). However, there has been very little study in oceanic waters, and no specific abundance estimates in this area are available. This species' primary range is beyond the shelf break in areas such as the East Coast of the United States, the Gulf of Mexico, and the Caribbean Sea (Fulling et al. 2003; Mullin and Fulling 2003; Mullin et al. 2004; Roden and Mullin 2000). Atlantic spotted dolphin typically occur over the continental shelf, usually at least 26 to 66 feet offshore (Davis et al. 1998; Perrin 2002; Perrin et al. 1994). Higher numbers of spotted dolphins are reported over the west Florida continental shelf from November to May than during the rest of the year, suggesting that this species undergoes a migration (Griffin and Griffin 2003). There are estimated to be about 50,978 Atlantic spotted dolphins along the eastern coast of the United States (Waring et al. 2009). This species is likely to be transient through the ROI.

White-Beaked Dolphin *(Lagenorhynchus albirostris)*

White-beaked dolphins are found in cold-temperate and subarctic waters of the North Atlantic. In the western North Atlantic Ocean, the white-beaked dolphin occurs from eastern Greenland through the Davis Strait and south to Massachusetts (Lien et al. 2001). Off the northeastern United States, white-beaked dolphin sightings are concentrated in the western Gulf of Maine and around Cape Cod (Cetacean and Turtle Assessment Program 1982; Palka et al. 1997). Sightings are most common in nearshore waters of Newfoundland and Labrador (Lien et al. 2001). There are few abundance estimates for the western North Atlantic stock, but numbers have estimated a minimum of 2,003 individuals along the east coast of the United States (Waring et al. 2009). This species is likely to be transient through the ROI.

Hooded Seal *(Cystophora cristata)*

Hooded seals are distributed in the Arctic and the cold temperate North Atlantic Ocean (Bellido et al. 2007). Their primary range extends south to the Labrador Peninsula and the Scotian Shelf (Bellido et al. 2007). Extralimital sightings have occurred between New England and Florida in the United States. Additionally, six reports of hooded seal strandings occurred between 1975 and 1996 in North Carolina, Florida, Georgia, Puerto Rico, and the U.S. Virgin Islands (Mignucci-Giannoni and Odell 2001). It is estimated that the global population of hooded seals is 450,000 to 550,000 individuals (Hammill et al. 1997; Waring et al. 2009). This species is likely to be transient through the ROI.

3.2.5 Coastal and Marine Birds

The proposed Project is located within the Atlantic oceanic migratory flyway and near the Atlantic coastal migratory flyway. The Atlantic oceanic migratory flyway is a loosely defined corridor generally encompassing most of the OCS waters of the eastern seaboard, including the New York Bight. Migrants using the Atlantic oceanic flyway may include songbirds, shorebirds, waterfowl, some terns, and other species moving between eastern North America (arctic Canada, Atlantic Canada, northeastern United States, and the Mid-Atlantic states) and southern North America, the Caribbean, Central America, and South America. Seabirds, sea ducks, and other resident avifauna may also occur in the New York Bight year-round.

This section discusses the avian species likely to occur within the ROI and adjacent offshore, nearshore, and onshore areas (Table 3.2-6). The population of birds in the marine environment is dynamic, with seasonal changes in species composition and abundance. There is limited survey data or literature available on avifauna in the ROI. The few existing datasets provide a general assessment of bird abundance, temporal distribution, and spatial occurrence patterns in the region (O'Connell et al. 2008; 2011).

The nature of the marine environment and the mobility of avian species make the occurrence of a variety of species possible at nearly any location in the New York Bight year-round (Gaston 2004; O'Connell et al. 2011). In general, avian abundance and species diversity decrease with distance from land, as demonstrated by studies in Europe and the Mid-Atlantic (Petersen et al. 2006; NJDEP 2010). Therefore, species richness and density in the ROI are likely to be substantially less than coastal areas of the New York Bight.

There are several groups of coastal and marine birds that inhabit the ROI, as presented in Table 3.2-6. Discussion following Table 3.2-6 is limited to those species groups that are most likely to occur within coastal margins and nearshore and offshore waters of the New York Bight. Birds with additional federal protection are discussed in Section 3.3.1.

Table 3.2-6. Major Groups of Birds in the ROI

Species Group present in ROI a/	Family	Number of Species Expected or Known to Occur in the ROI	Seasonal Presence				Offshore or Onshore
			Winter	Spring	Summer	Fall	
Loons	Gaviidae	2	X	X	X	X	Offshore
Grebes	Podicipedidae	3	X				Offshore
Tubenoses (Shearwaters, Petrels, and Fulmars)	Procellariidae	7			X		Offshore
Storm-petrels	Hydrobatidae	2			X		Offshore
Pelicaniformes	Sulidae, Pelecanidae	2	X	X	X	X	Offshore
Cormorants	Phalacrocroacidae	2					Both
Waterfowl	Anatidae	31	X	X		X	15 species primarily Offshore, 16 species primarily Onshore
Raptors	Acciptridae, Falconidae, Cathartidae	15	X	X	X	X	Primarily Onshore, at least 3 species commonly migrate Offshore
Shorebirds	Charadriidae, Haematopodidae, Scolopacidae	34	X	X	X	X	30 species primarily coastal or Offshore during migration, 2 species Onshore in uplands, 2 species primarily Offshore
Jaegers and skuas	Laridae	5			X		Offshore
Gulls and kittiwakes	Laridae	10	X	X	X	X	Primarily Offshore
Terns	Laridae	10		X	X	X	Primarily Offshore, but also coastal.
Alcids	Alcidae	5	X				Offshore, 2 of the 5 species only occur rarely in the Mid-Atlantic
Owls	Strigidaae and Tytonidae	1	X				1 species known to occur Offshore during winter
Other landbirds and songbirds	Multiple (Primarily Passeriformes)	8 in offshore areas, >100 terrestrial species		X	X	X	Primarily Onshore, may occur Offshore during migration

a/ Poole, A. (Editor) 2005

Loons (Order Gaviiformes)

Common loon (*Gavia immer*) and red-throated loon (*Gavia stellata*) regularly occur on the New York Bight (O'Connell et al. 2008; Evers et al. 2010). Recent studies indicate that loons are more abundant in the marine environment near the mouth of large bays than they are further offshore (NJDEP 2010). Modeling of loon distribution in the Mid-Atlantic by O'Connell et al. (2009) confirms the general spatial distribution trends observed during the interim 2012 Mid-Atlantic Baseline Study (NJDEP 2010). The spatial distribution of loons on the OCS is likely a function of prey availability, weather conditions, and benthic habitats (Barr et al. 2000; Evers et al. 2010). Foraging loons are less constrained by water depths than are other diving birds, such as sea ducks, because their prey consists primarily of pelagic fish, in contrast to the infaunal and benthic prey of sea ducks (Evers et al. 2010). Therefore, loons may be attracted to certain portions of the ROI if food resources become concentrated.

Grebes (Order Podicipediformes)

Grebes may occur in low densities during migration or the wintering period off the coast of New Jersey and New York (Stout and Nuechterlein 1999). Horned grebes (*Podiceps auritus*) have been regularly observed in the Mid-Atlantic region and farther north (Williams 2013). Horned grebes are expected to occur in the New York Bight region at relatively low densities during the winter (O'Connell et al. 2009). Red-necked grebe (*Podiceps grisegena)* may occur in the area, primarily nearshore during the winter months (Stout and Nuechterlein 1999). Pied-billed grebe (*Podilymbus podiceps*) may use the coastal waters of the New York Bight (Muller et al. 1999).

Waterfowl (Order Anseriformes)

Sea ducks and diving ducks (*Anatidae*) may be present in the ROI throughout the year, but are likely to be most abundant from November to April in coastal and shoal waters (O'Connell et al. 2009). During southward migration, sea ducks begin to arrive in the region in November and December, and depart during spring migration to more northerly breeding areas in March and April (O'Connell et al. 2009).

Sea ducks are likely the most common waterfowl in the ROI. Other ducks, including dabbling ducks such as American black duck (*Anas rubripes*), wood duck (*Aix sponsa*), and mallards (*Anas platyrhynchos*), may also occur offshore during migration. The spatial distribution of sea ducks in the New York Bight is largely a function of water depths and prey availability, as well as fluctuations in annual climatic trends (i.e., higher concentrations of some species nearer to shore during colder winters) (Bordage et al. 2011). O'Connell et al. (2009) modeled the spatial distribution of sea ducks in the western Atlantic, and their results showed that sea ducks in general were more abundant near the mouth of large bays and along the peninsulas, and occur at lower abundances farther offshore.

Seabirds

Surveys of seabirds in the Mid-Atlantic region demonstrate that the occurrence of pelagic birds, such as shearwaters and storm-petrels, is episodic and related to shifting patches of food resources, physical oceanographic variables, and changes in weather conditions (Harrison 1987; O'Connell et al. 2009). Studies have shown that shearwaters and storm-petrels are most abundant in the western Atlantic during the summer months. Although some species, such as Manx's shearwater (*Puffinus puffinus*), may occur year-round (O'Connell et al. 2009), shearwaters generally occur in the New York Bight during the non-breeding austral-winter period, in May through September, although some species may be present year-round (Lee and Haney 1996; O'Connell et al. 2009). Storm-petrels (*Hydrobatidae*) occur in the ROI primarily during the non-breeding austral-winter period, but some species may also be present year-round (Huntington et al. 1996; O'Connell et al. 2009).

There are four seabird species listed as birds of conservation concern (BCC): Audubon's shearwater (*Puffinus lherminieri*), black-capped petrel (*Pterodroma hasitata*), greater shearwater, and band-rumped storm-petrel (*Oceanodroma castro*) (USFWS 2008a). With the exception of the greater shearwater, no BCC seabirds are expected to commonly occur on the New York Bight. Greater shearwater are distributed throughout the western Atlantic (O'Connell et al. 2009).

Northern Gannet and Cormorants (Order Pelicaniformes)

The Order Pelecaniformes is a diverse group of large seabirds, including pelicans, gannets, and cormorants (American Ornithologists' Union 1998) that occur within the ROI. Great cormorant (*Phalacrocorax carbo*) is a BCC (USFWS 2008a). Great cormorants and double-crested cormorant (*Phalacrocorax auritus*) predate on small fish in coastal and shallow waters (Fay et al. 2006; NMFS and

USFWS 2005). Double-crested cormorants are likely to be present in coastal and shoal waters year-round; great coromorants may occur in shallow waters during the winter.

Northern gannet (*Morus bassanus*) migrate from breeding areas in Atlantic Canada to lower latitudes of the New York Bight in late summer and early fall; individuals are known to overwinter as far south as Georgia and Florida (Mowbray 2002; O'Connell et al. 2009). Gannets are likely to be present in the ROI during fall, winter, and early spring (O'Connell et al. 2009; NJDEP 2010).

Shorebirds

Shorebirds may occur in coastal areas of the New York Bight year-round, including during the spring-summer breeding periods (O'Connell et al. 2011). Red-necked phalarope (*Phalaropus lobatus*) and red phalarope (*Phalaropus fulicarius*) are the only shorebird species known to regularly occur on the open ocean. Other species may migrate over the open ocean, but are not known to land on the water's surface, and therefore spend considerably less time offshore than phalaropes (Tracy et al. 2002). An additional 32 shorebird species are known to regularly occur in coastal New York and New Jersey, two of which occur exclusively inland and are unlikely to occur in the ROI (upland sandpiper [*Bartamia longicauda*] and Wilson's snipe [*Gallniago delicate*]) (Houston et al. 2011). The coastal areas of the New York Bight may provide stopover habitat for a variety of shorebirds breeding in more northern latitudes. Piping plover (*Charadrius melodus*) may occur in dune, upper beach, and intertidal areas during migration (Elliott-Smith and Haig 2004). Red knot (*Calidris canutus*), a candidate species for federal listing, winters on the Mid-Atlantic coast, and may occur in coastal locations (Harrington 2001). Threatened and endangered species are further discussed in Section 4.3.

Gulls and Allies

Gulls occur year-round on the coast of New York and New Jersey and on the New York Bight. Due to their overall abundance in the region and generalist habits, gulls are likely to be the most ubiquitous seabirds in the ROI (Pierotti and Good 1994; Good 1998).

Jaegers may occur uncommonly on the New York Bight, primarily during fall and winter (O'Connell et al. 2009). Skuas rarely occur in the region during spring and fall migration (south polar skua [*Stercorarius maccormicki*]) or during the winter (great skua [*Sterocrarius skua*]) (O'Connell et al. 2009). Jaegers tend to occur primarily along the edge of the continental shelf, or along the western edge of the gulf stream in the New York Bight region (Wiley and Lee 2000).

Terns (*Sternidae*) may occur in the ROI during the summer residency period. Tern diversity is particularly high in the Mid-Atlantic region, where up to 12 species may occur (Table 3.2-7). Roseate tern (*Sterna dougallii dougallii*) is federally listed as threatened species (O'Connell et al. 2009).

Table 3.2-7. Tern Species Seasonal Presence in the ROI

English Name	Scientific Name	Seasonal Presence				Likelihood of Occurrence
		Winter	Spring	Summer	Fall	
Black tern	*Childonia niger*		X		X	Low
Caspian tern	*Sterna caspia*		X		X	High
Gull-billed tern	*Sterna nilotica*		X	X	X	Moderate
Royal tern	*Sterna maxima*		X	X	X	High
Sandwich tern	*Sterna sandvicensis*		X	X	X	High

English Name	Scientific Name	Seasonal Presence				Likelihood of Occurrence
		Winter	Spring	Summer	Fall	
Common tern	*Sterna hirundo*		X	X	X	High
Forster's tern	*Sterna forsteri*	X	X	X	X	High
Arctic tern	*Sterna paradisaea*		X		X	Low
Roseate tern	*Sterna dougallii*		X		X	Low
Least tern	*Sterna antillarum*		X	X	X	High
Sooty tern	*Sterna fuscata*		X		X	Low
Bridled tern	*Sterna anaethetus*		X		X	Low

Potential for Occurrence Onsite: Unlikely– no species range overlap with ROI or unsuitable habitat in ROI; Low– species range overlaps with proposed Project and marginally suitable habitat in vicinity; Moderate– species range overlaps with proposed Project and suitable habitat present, or species known to occur in habitat similar to the proposed Project location; High–highly suitable habitat present in the proposed Project location, or known populations exist in the proposed Project vicinity, Present - species observed during field survey.
Source: O'Connell et al. 2009

Raptors

Falcons and osprey are the only raptors known to routinely undertake long, open ocean migratory flights (Mellone et al. 2011). Although primarily diurnal migrants, some species may migrate at night (DeCandido et al. 2006). Raptor species that rely on thermal updrafts and soaring (e.g., *Buteo* spp.) for migration generally avoid water crossings (Kerlinger 1995). Other species, including accipiters (*Accipiter* spp.), osprey (*Pandion haliaetus*), and bald eagle (*Haliaeetus leucocephalus*) may undertake water crossings of variable length, but are not frequently encountered on the open ocean (Buehler 2000; Alerstam et al. 2003; DeCandido et al. 2006). Peregrine falcon (*Falco peregrinus*) and merlin (*Falco columbarius*) are observed regularly offshore during migration (NJDEP 2010).

Overall, it is unlikely that eagles occur regularly in the ROI. Bald eagles may migrate through the region, but are not known to regularly occur on the open ocean, and only occur locally on the New Jersey and New York coasts (Buehler 2000). Bald eagles are protected under the Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. 668-668d).

Neotropical Migrant Songbirds

The neotropical migrant passerines (songbirds) may fly over offshore waters during migration and may occur on the New York Bight, during southward or northward migration. Most neotropical migrant passerine species are migrate at night (Kerlinger 1995). Oceans are typically an obstacle for this group; therefore, neotropical migrants tend to avoid large water crossings and follow land to the extent possible. Migration has a substantial risk to birds, ranging from mass mortality events due to inclement weather (Newton 2007) and other mortality events associated with lighting of vessels (Merkel and Johansen 2011) and oil and gas platforms (Poot et al. 2008). However, most neotropical migrants, especially warblers and thrushes from the family Parulidae and family Turdidae, cross water at some point twice a year to reach their wintering and breeding grounds.

Bat Species

Ten bat species are believed to have the potential to occur in coastal areas adjacent to the New York Bight (Harvey et al. 2011) (Table 3.2.8). No federal ESA-listed species are expected to occur in the ROI, either offshore or onshore. Few data sources exist regarding the distribution of bats in coastal New York and New Jersey, or in adjacent offshore areas, although bats are known to occur offshore. Passive acoustic monitoring for bats is ongoing along the Atlantic Coast and offshore in state waters (Pelletier et al. 2013). Given the occurrence of estuaries, freshwater wetlands, and open water, it is expected that most of the more common bat species in the area occur or migrate through coastal New York and New Jersey, but are unlikely to occur offshore. Some species may occur farther offshore during migration, primarily eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and silver-haired bat (*Lasionycteris noctivagans*). Because the ROI is located approximately 20 nautical miles from shore, bats are not expected to regularly occur in the area.

Table 3.2.8. Bat Species that May Occur on the Coast near the ROI

Common Name	Scientific Name
Eastern small-footed myotis	*Myotis leibii*
Little brown myotis	*Myotis lucifugus*
Northern long-eared myotis	*Myotis septentrionalis*
Indiana bat	*Myotis sodalis*
Tri-colored bat	*Perimyotis subflavus*
Big brown bat	*Eptesicus fuscus*
Silver-haired bat	*Lasionycteris noctivagans*
Eastern red bat	*Lasiurus borealis*
Hoary bat	*Lasiurus cinereus*
Northern yellow bat	*Lasiurus intermedius*

The northern long-eared myotis (*Myotis septentrionalis*) has been proposed for listing under the ESA, but is a non-migratory species and is not known to occur offshore. The Indiana bat (*Myotis sodalis*) is listed as endangered under the ESA, but is not known to occur offshore.

3.2.6 Marine Protected Areas

MPAs are defined in Executive Order (EO) 13158 as "any area of the marine environment that has been reserved by federal, state, territorial, tribal or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." There are no MPAs within the ROI, as shown in Figure 3.2-1. The only MPA located in the vicinity of the proposed Port facilities (within a 20-nautical mile radius) is the Gateway National Recreation Area (GNRA).

Other areas such as dump sites, artificial reefs, and seasonal management areas (SMA) are not designated MPAs as defined by the EO. A detailed discussion on such ocean uses is found in Section 3.7.1.

3.2.6.1 Gateway National Recreation Area (GNRA)

The 26,600 acres that make up the GNRA park system was set aside by the U.S. Congress in 1972. The goal was to "preserve unique natural, cultural, and recreational resources with relatively convenient access by a high percentage of the nation's population." A diversity of plants and animals can be found within the various ecosystems of the park. Marine environments, such as sandy beaches and salt marshes, provide habitat for a variety of organisms, including seagrasses, fish, and crustaceans. Upland forests and freshwater ponds support additional diversity, such as shrubs, small mammals, and birds. In fact, over 300 species of birds use the GNRA during spring and fall migrations to rest and forage. Because of its high usage and geographic location, it is considered an important stopover along the Atlantic Flyway (NPS 2012). Additionally, its beaches provide nesting habitat for the protected piping plover. The GNRA is managed by the National Park Service and is comprised of three separate units:

- **The Jamaica Bay Unit**, located in Brooklyn and Queens, stretching from Plumb Beach to Kennedy International Airport (24.1 nautical miles from the proposed Port facilities).
- **The Staten Island Unit**, located on the southeastern shore of Staten Island (31.1 nautical miles from the proposed Port facilities).
- **The Sandy Hook Unit**, located on the Peninsula of Sandy Hook, near Highlands, New Jersey (24.6 nautical miles from the proposed Port facilities).

3.3 Threatened and Endangered Marine Mammals, Sea Turtles, Fish, and Birds

The federal government established the ESA in 1973 (16 U.S.C. 1531–1534) in order to protect species vulnerable to extinction, as well as their environments. Marine organisms are under the jurisdiction of NOAA Fisheries, while terrestrial and freshwater organisms are overseen by the USFWS, though some species require special consideration and may be managed by both agencies. The ESA defines "endangered" as a species in danger of extinction in all or a significant portion of its range. "Threatened" is then defined as a species that is likely to become endangered in the foreseeable future. If a federal agency undertakes an activity that may impact an "endangered" or "threatened" species, they must first consult with the USFWS or NOAA Fisheries, or both, according to Section 7 of the ESA.

Under the ESA, the U.S. Coast Guard (USCG) has the responsibility to determine whether or not the proposed Project would adversely affect federally listed threatened or endangered species and their critical habitat. If, upon review of existing data or data provided by the Applicant, the USCG determines that either a species or habitat or both might be affected by the proposed Project, the USCG must prepare a Biological Assessment (BA) to consider the type of effect and extent of impact. In addition to an impact analysis, recommendations must be made for ways to eliminate or mitigate potential adverse effects.

The BA (also see Sections 2.0 and 4.3 of this draft EIS) prepared by the USCG would aid in the interagency consultation determination of whether the potential impacts from the proposed Project are likely to jeopardize any listed species or result in the destruction or adverse modification of designated critical habitats. After consultation, the USFWS or NOAA Fisheries would issue a BO expressing their opinion about the potential for impacts to occur. If their opinion is that the proposed Project would likely negatively impact any listed species or their designated critical habitat, they may decide to issue an incidental take statement, which would act as an exception to ESA prohibitions. If the USCG determines that no federally listed (or proposed) species or their designated critical habitat would be affected by the proposed Project, no further action is necessary. There are no areas of critical habitat that overlap the ROI, so critical habitat is not discussed further.

The USCG is currently engaged in informal consultation with NOAA Fisheries and USFWS regarding the potential impacts, monitoring plans, and subsequent mitigation of the proposed action on federally listed threatened and endangered species. Any consultation would be completed before the Record of Decision (ROD) on the proposed Project and within the time allowed in 33 CFR 1501.4(c)(6) for the U.S. Environmental Protection Agency (USEPA) to notify the Secretary that the proposed Project would not conform with all applicable provisions of the CAA, the Federal Water Pollution Control Act of the MPRSA and 33 CFR 1501.4(c)(6) 1501.4(c)(8). All consultation correspondence to date is located in Appendix D of this draft EIS.

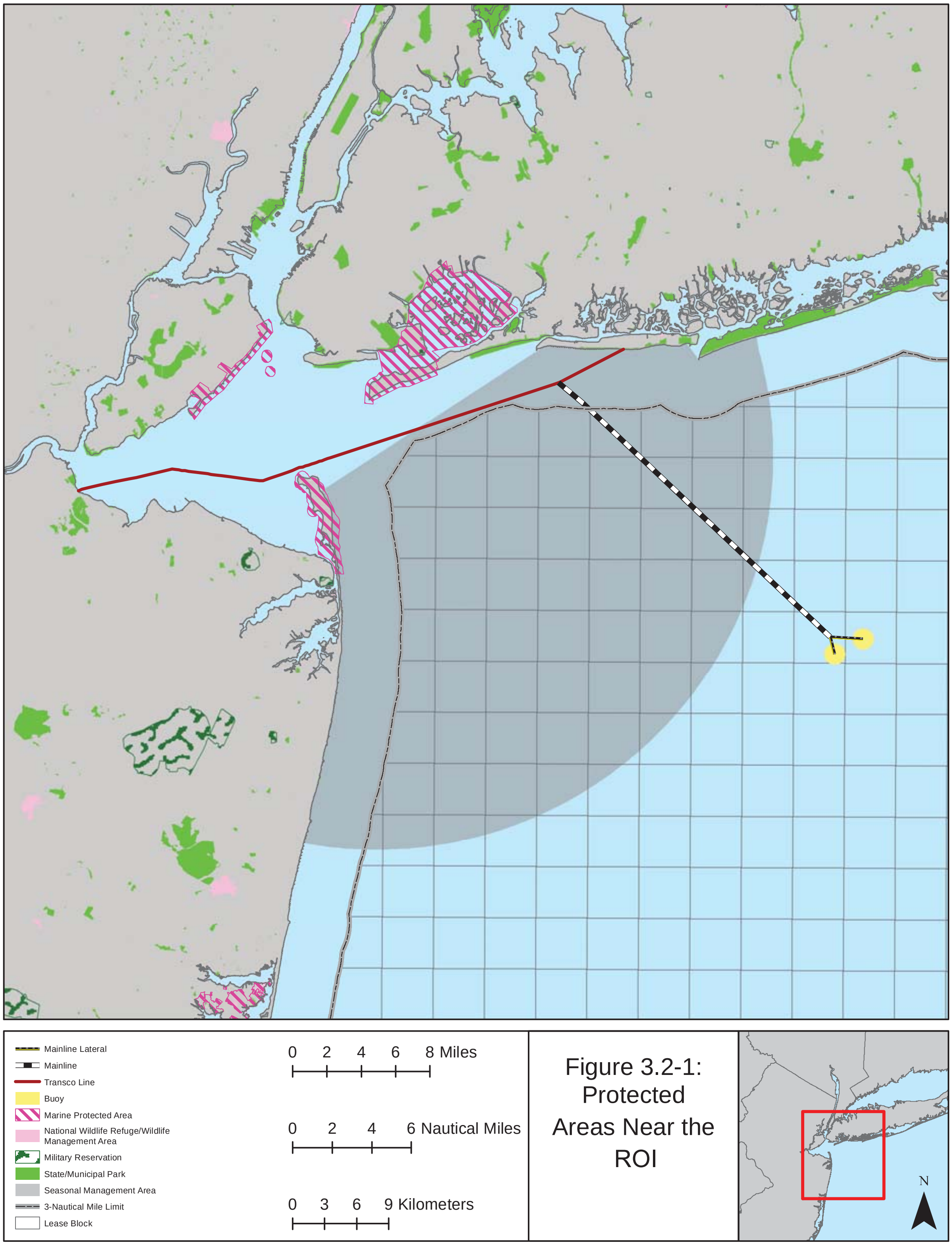

Figure 3.2-1. Protected Areas Near the ROI

3.3.1 Identified Species and General Characteristics

All federally listed threatened and endangered species of marine mammals, sea turtles, or birds that have potential habitat or known occurrence in the ROI are described in further detail below. These include a total of 13 threatened or endangered species (six marine mammals, four sea turtles, one fish, and two birds; see Table 3.3-1).

One marine mammal species not included in this assessment is the West Indian manatee (*Trichechus manatus latirostris*), whose normal distribution is confined to the warmer waters of Florida and other southeastern states (USFWS 1999a). Individuals venturing outside this range likely would remain close to shore, since they would need to stay in warmer waters close to foraging sites with vegetation and nearby freshwater. Since the ROI does not meet this species' requirements, it would preclude a rare West Indian manatee from entering the ROI. Similarly, although the hawksbill sea turtle (*Eretmochelys imbricata*) is among the five species of sea turtles known from the New York Bight, the species is so exceptionally uncommon in the ROI (NYSDEC 2012) that it is not included in this assessment.

A population of the federally endangered shortnose sturgeon (*Acipenser brevirostrum*) occurs in the Hudson River and has been documented from the Troy Dam to the waters near Staten Island in the New York Harbor (NMFS 2012a). Since only transient individuals are present on rare occurrences within the ROI, shortnose sturgeon are not further discussed in this assessment.

In addition, ESA-listed marine vegetation and invertebrates are excluded from this assessment because they do not occur in the ROI. Finally, candidate species (i.e., candidates for ESA listing) are not addressed in this document. Candidate status does not provide species protection under the listing process, and consultation (formal or informal) is not required for candidate species under the ESA Section 7 requirements.

Table 3.3-1. Species Status and Potential for Occurrence in ROI

Common Name	Scientific Name	Occurrence in New York Bight	ESA and MMPA Status
Blue whale	*Balaenopera musculus*	Unlikely, prefers deeper waters	Endangered
Fin whale	*Balaenoptera physalus*	Abundant, Year-Round	Endangered
Humpback whale	*Megaptera novaeangilae*	Common, Seasonal	Endangered
North Atlantic right whale	*Eubalaena glacialis*	Rare, Seasonal	Endangered
Sei whale	*Balaenoptera borealis*	Rare, Seasonal	Endangered
Sperm whale	*Physeter macrocephalus*	Unlikely, prefers deeper waters	Endangered
Kemp's ridley turtle	*Lepidochelys kempii*	Abundant, Seasonal	Endangered
Loggerhead turtle	*Caretta*	Abundant, Seasonal	Threatened
Green turtle	*Chelonia mydas*	Common, Seasonal	Endangered
Leatherback turtle	*Dermochelys coriacea*	Abundant, Seasonal	Endangered
Atlantic sturgeon	*Acipencer oxyrinchus*	Rare, Seasonal	Endangered
Roseate tern	*Sterna dougallii*	Patchy along coast, Seasonal	Endangered
Piping Plover	*Charadrius melodus*	Isolated/rare along coast, Seasonal	Threatened

Blue Whale *(Balaenopera musculus)*

Blue whales are listed as endangered under the ESA. A recovery plan is in place for the blue whale in U.S. waters. Between 1904 and 1973, extensive whaling decimated the population to one percent (approximately 360 individuals) of its pre-exploitation population size. Blue whale abundance has slowly been rising over the past few decades, and the blue whale is currently thought to number approximately 8,000 to 9,000 individuals globally (Jefferson et al. 2008; McDonald et al. 2009); however, blue whale populations in the western North Atlantic may number only in the low hundreds (Waring et al. 2009). Blue whales are found alone or in pairs, though larger aggregations of 10 or more animals are known to occur in feeding grounds (Jefferson et al. 2008; Schoenherr 1991).

Because blue whales feed on zooplankton and krill so heavily, they follow the temporal migration of their krill prey, spending much of their time along these fronts (Doniol-Valcroze et al. 2007). Through lunge feeding, blue whales consume approximately 6 tons (5,500 kilograms) of krill per day. They sometimes feed at depths greater than 328 feet, where their prey maintains dense groupings (Acevedo-Gutiérrez et al. 2002).

Blue whales spend most of their time near the coast, over the continental shelf, though they are sometimes found in oceanic waters. Members of the North Atlantic population spend much of their time on continental shelf waters from eastern Canada (near the Quebec north shore), to the St. Lawrence Estuary and Strait of Belle Isle. Sightings have been reported along the southern coast of Newfoundland during late winter and early spring (Reeves et al. 2004). Blue whales are most frequently sighted in the waters off eastern Canada. Most recent records come from the Gulf of St. Lawrence (Waring et al. 2009). Open ocean habitat of the blue whale includes the Gulf Stream and North Central Atlantic Gyre. Although the exact extent of their southern boundary and wintering grounds are not well understood, the blue whale is thought to occasionally be found in waters off of the U.S. Atlantic coast (Waring et al. 2009).

Fin Whale *(Balaenoptera physalus)*

Also known as the finback whale, the fin whale is widely distributed throughout the Mid- and North Atlantic coasts. The fin whale is listed as endangered under the ESA and is considered depleted (below the optimal sustainable population level) under the MMPA. Approximately 4,000 individuals comprise the North Atlantic stock (Waring et al. 2012). They are found mainly, but not exclusively, in offshore waters. The fin whale is found regularly in the New York Bight and has been observed via both visual and acoustic detection surveys (Morano 2012). Experts estimate that groups of 20 to 200 are not uncommon (Branch and Butterworth 2001; Canese et al. 2006; Coakes et al. 2005). No critical habitat has been designated for this species.

The fin whale’s summer feeding grounds are found principally in New England waters, although they occur from New England to the Arctic (Waring et al. 2012; IUCN 2012a). Accordingly, fin whale density near the ROI is highest in the summer (NYDOS 2013). Migration from high-latitude feeding grounds generally occurs in the fall months from the Labrador/Newfoundland region, south past Bermuda, and into the West Indies (NMFS 2006a). During this migration, fin whales can be spotted along the New York Bight, traveling along the 656-foot depth contour. The overwinter locations used by the majority of fin whales is mostly unknown, but wintering grounds have been documented in the subtropics and West Indies. As early as mid-winter and through early spring, fin whales are found within a mile of the shoreline along the eastern portions of Long Island and the New York Bight Apex (at the mouth of New York/New Jersey Harbor) (Morano et al. 2012), apparently feeding on schooling fish. Fin whales feed on small invertebrates (e.g., copepods), as well as squid and schooling fish, such as capelin, herring, and mackerel (Goldbogen et al. 2006; Jefferson et al. 2008).

Humpback Whale *(Megaptera novaeangilae)*

Humpback whales are listed as endangered under the ESA and depleted under the MMPA. There are an estimated 12,000 humpback whales in the entire North Atlantic population (Waring et al. 2012). Critical habitat has not been designated for the species.

Humpback whales feed on a variety of invertebrates and small schooling fish. The most common invertebrate prey is krill; the most common fish prey are herring, mackerel, sand lance, sardines, anchovies, and capelin (Clapham and Mead 1999). The diet of the humpback whale in the New York Bight area consists of small schooling fish, such as herring, sand lance, and mackerel (USFWS 1997). Feeding occurs wherever prey is abundant, both at the surface and in deeper waters.

Humpback whales migrate over long distances, as a large percentage of the North Atlantic humpback whales are known to overwinter in the West Indies and the Caribbean (Calambokidis 2009). Most humpback whales migrate from high-latitude summer feeding grounds to these low-latitude winter breeding grounds, one of the longest migrations known for any mammal. Some individuals do not migrate, however, and significant numbers of the species can be found remaining in mid- and high-latitude regions (Clapham et al. 1993). This results in occasional sightings of whales during winter months in New England waters. Their summer feeding grounds are principally between the Gulf of Maine and Iceland. In general, during the summer months, humpback whales in the western North Atlantic migrate and/or feed over the continental shelf and along the coasts of Iceland, southwestern Greenland, the Newfoundland and Labrador coasts, the Gulf of St. Lawrence, and the Gulf of Maine (Waring et al. 2012; IUCN 2012b). During the winter migration, humpback whales generally migrate to wintering and feeding grounds in open offshore pelagic waters, but they occasionally may be sighted in coastal waters along the U.S. coast. Most humpback whales return to traditional winter locations at the lower latitudes, usually between 10° N and 35° N around the Greater and Lesser Antilles. Breeding and birthing most often occurs in the wintering grounds in the West Indies (IUCN 2012b).

Humpback whales are found in the New York Bight in both summer and winter. Although they are found regularly via visual and acoustic detection surveys, experts estimate that fewer than 50 to 100 animals are in the New York Bight at any one time (USFWS 1997). Because humpback whales prefer deeper waters of the continental shelf, they are less likely to be found near the ROI and instead prefer the deeper areas of the New York Bight; however, recent annual abundance data has indicated moderately low abundance of this species in the vicinity of the ROI, particularly during the fall months (NYSDEC 2013b; NYDOS 2013).

North Atlantic Right Whale *(Eubalaena glacialis)*

The North Atlantic right whale is the most endangered large whale species with an estimated 396 individuals in the western North Atlantic (Waring et al. 2012). The North Atlantic right whale is listed as endangered under the ESA and is depleted under the MMPA. Critical habitat was designated for this species in 1994 (NMFS 1994) and is currently under review for possible revision. The three areas designated as critical habitat are coastal Florida and Georgia, Great South Channel (east of Cape Cod), and Massachusetts Bay and Cape Cod Bay (NMFS 1994). No critical habitat coincides with or adjoins the ROI.

The North Atlantic right whale's primary range is from wintering (breeding) grounds in the southeastern United States (Florida and Georgia) to summer feeding grounds, principally from New England to the Scotian Shelf in Canada (Waring et al. 2012). Right whales are thought to breed and birth mostly during the winter at lower latitudes (Wynne and Schwartz 1999). The North Atlantic right whale preys primarily on the copepod *Calanus finmarchicus* (a type of zooplankton) and on other copepods and small invertebrates, such as krill and larval barnacles (Jefferson et al. 2008). North Atlantic right whales are skim feeders and are known to feed below or at the surface (Kenney et al. 2001) or within a few meters of the seafloor on near-bottom aggregations of copepods (Baumgartner et al. 2003). Occasionally, several

North Atlantic right whales have been observed feeding in association with large blooms of calanoid copepods (USFWS 1997).

Based on data from the Okeanos Foundation, the New York Bight waters function mainly as a migration pathway for this species, with sightings of cow-calf pairs and solitary individuals occasionally feeding along their journey to summering grounds in Cape Cod Bay (USFWS 1997). During their southward migration, North Atlantic right whales seem to move further offshore after they pass Cape Cod, reappearing somewhere off the Georgia and Florida coasts as they complete their annual migration cycle (USFWS 1997). Results of some studies suggest that this region of the southeast United States may not only be a migratory route but also a residency area for some individuals (Glass et al. 2005). North Atlantic right whales have also been detected acoustically within 8.6 nautical miles of the New York Harbor (Dell'Amore 2011).

Many factors are contributing to the decline of the North Atlantic right whale (Moore et al. 2009). The major threats to right whales are entanglement in fishing gear and vessel strikes. Although it is illegal for fishing operations to target North Atlantic right whales, they have been documented as bycatch (caught unintentionally) in both northeast and southeast U.S. Atlantic fisheries (Zollett 2009). Entanglement in a variety of types and parts of fixed fishing gear causes a significant number of injuries and deaths of North Atlantic right whales (Johnson et al. 2005). Vessel strikes pose a particularly serious threat to the North Atlantic right whale (Silber et al. 2012), because these individuals spend most of their time at the water surface, and data shows most vessel strikes are fatal to right whales (Jensen and Silber 2003). In addition to these anthropogenic threats, competition with other whales for food also may be contributing to their decline (Patrician and Kenney 2010). Other threats to the species include habitat degradation, contaminants, climate change, anthropogenic noise, disturbance from whale watching vessels, and predators (NOAA/NMFS 2012b). Exposure to the poisonous substance, domoic acid, found in oceanic waters may also contribute to the decline of the North Atlantic right whale population (Leandro et al. 2010).

The proposed Mainline route would cross into the Mid-Atlantic SMA for the North Atlantic right whale (NOAA 2013) (Figure 3.2-1). This SMA is effective from November 1 through April 30 of each year. *Federal Register* rules were initially proposed to reduce ship strikes (NOAA 2006); these were finalized under the "Final Rule to Implement Speed Restrictions to Reduce the Threat of Ship Collisions with North Atlantic Right Whales" (NOAA 2008) and extended in November 2013 (NOAA 2013). Under this final rule, NOAA Fisheries established regulations to implement speed restrictions applying to all vessels 65 feet or longer in certain locations and at certain times of the year along the east coast of the Atlantic seaboard. Vessels in this category must travel at 10 knots or less in designated SMAs in order to reduce the threat of ship collisions to certain whale species. The regulations provide for a mechanism to reduce the likelihood of deaths and serious injuries to the North Atlantic right whale, a species prone to ship strikes. The surrounding waters are considered to be part of the North Atlantic right whale migratory route and calving ground habitat in the Mid-Atlantic SMA and do have mandatory speed reduction requirements.

North Atlantic right whales are infrequently sighted in waters immediately adjacent to the ROI (USFWS 1997), and are not expected to occur in the ROI on a regular basis. Recent seasonal abundance data indicates that the presence of North Atlantic right whales is low within the Atlantic Ocean waters offshore New York (NYSDEC 2013c). The highest observed densities near New York occur during summer and fall but are east of the ROI (NYDOS 2013). In addition, waters are too shallow and the ROI is not favorable habitat for this species, given the amount of existing shipping traffic.

Sei Whale *(Balaenoptera borealis)*

The sei whale is listed as endangered under the ESA. There are two suggested stocks for the sei whale in the North Atlantic: a Nova Scotia stock and a Labrador Sea stock (Waring et al. 2009). While sei whales currently appear to be recovering in the Northern Hemisphere as a result of legal protections, there are few reliable estimates of sei whale abundance, and they do not appear to be abundant in any part of their range. Current global abundance is considered to be a minimum of 80,000 individuals (Horwood 2008; Jefferson et al. 2008).

Group sizes are generally low but are believed to vary by location (Horwood 2008). In temperate waters, animals are often solitary. Within feeding habitat, they can be solitary or they can form large aggregations of up to 100 individuals (Horwood 2008). Feeding occurs primarily on small prey such as copepods, krill, cephalopods, sardines, and anchovies; no major predators have been documented (Jefferson et al. 2008).

Sei whales have a worldwide distribution and are found primarily in cold temperate to subpolar latitudes. They are typically found in the deep waters of the open ocean and are rarely observed within the New York Bight or in coastal waters (Horwood 2008; Jefferson et al. 2008). Recent satellite tagging data indicate sei whales feed and migrate east-to-west across large sections of the North Atlantic (Olsen et al. 2009). They also appear to prefer regions such as the continental shelf break, canyons, or basins situated between banks and ledges (Best and Lockyer 2002; Kenney and Winn 1987). These areas attract high concentrations of zooplankton, particularly copepods. Within feeding grounds, distribution is largely associated with oceanic weather patterns (Horwood 1987; Moore et al. 2002). Characteristics of preferred breeding grounds are unknown, since these have generally not been identified. Sei whales spend the summer months feeding in high subpolar latitudes and return to lower latitudes to calve in winter.

Sperm Whale *(Physeter macrocephalus)*

Currently, there is no reliable estimate for the total number of sperm whales worldwide. The best estimate is that there are between 200,000 and 1,500,000 sperm whales, based on extrapolations from only a few areas that have useful estimates (NMFS 2006b). Estimates show about 1,665 in the northern Gulf of Mexico; 14,000 in the North Atlantic; 80,000 in the North Pacific; and 9,500 in the Antarctic (NMFS 2006b; Waring et al. 2009).

Sperm whales are highly social, with a basic social unit consisting of 20 to 40 adult females, calves, and some juveniles (Rice 1989; Whitehead 2008). During their prime breeding period and old age, male sperm whales are essentially solitary. Males rejoin or find nursery groups during prime breeding season. While foraging, the whales typically gather in small clusters. Between diving bouts, sperm whales are known to raft together at the surface. Adult males often forage alone. Groups of females may spread out over distances greater than 0.5 nautical mile when foraging. When socializing, they generally gather into larger surface-active groups (Jefferson et al. 2008; Whitehead 2003). In the Northern Hemisphere, the peak breeding season for sperm whales occurs between March and June, and in the Southern Hemisphere, the peak breeding season occurs between October and December (NMFS 2009d).

This species primarily preys on squid and octopus and are also known to prey on fish, such as lumpsuckers and redfish. Although sperm whales are generalists in terms of prey, specialization does appear to occur in a few places. The main sperm whale feeding grounds are correlated with increased primary productivity caused by upwelling.

The sperm whale is thought to have a more extensive distribution than any other marine mammal, except possibly the killer whale. This species is found in polar to tropical waters in all oceans, from approximately 70° N to 70° S (Rice 1989; Whitehead 2003). It ranges throughout all deep oceans of the world, essentially from equatorial zones to the edges of the polar pack ice. In the Atlantic, sperm whales are found throughout the Gulf Stream and North Central Atlantic Gyre.

Sperm whales show a strong preference for deep waters (Rice 1989; Whitehead 2003). Their distribution is typically associated with waters over the continental shelf break and the continental slope and into deeper waters (Jefferson et al. 2008; Whitehead et al. 1992). Sperm whale concentrations near drop-offs and areas with strong currents and steep topography are correlated with high productivity. These whales do not occur in the ROI and are almost exclusively found at the shelf break, regardless of season (NYDOS 2013). Sperm whales are somewhat migratory; however, their migrations are not as specific as seen in most of the baleen whale species. In the North Atlantic, there appears to be a general shift northward during the summer, but there is no clear migration in some temperate areas (Rice 1989; Whitehead 2003).

Kemp's Ridley Turtle *(Lepidochelys kempii)*

The Kemp's ridley turtle is classified as endangered under the ESA (NMFS and USFWS 1992b) and is considered to be in imminent danger of extinction (NRC 1990). A strong population growth rate in the early 2000s led one study to estimate that the Kemp's ridley population could increase to 10,000 nesting females found in southern tropical waters by 2015 (Heppell et al. 2005). Although the USFWS has not identified any critical habitat for this species, the NYSDEC (2012) classified Long Island's waters as state-defined critical habitat for immature (age two to five years) Kemp's ridley turtles (NYSDEC 2012).

The distribution of the adult Kemp's ridley population is concentrated in the Gulf of Mexico, with year-round occurrence throughout the Gulf and southern Atlantic coasts of Florida and seasonal occurrence along the Atlantic coast as far north as Nova Scotia (Lazell 1980; Morreale et al. 1992). The species nests primarily in Mexico and Texas, though occasional nestlings have been observed in the southeastern United States. Newly emerged hatchlings appear to develop in open ocean waters. The primary habitat of juvenile Kemp's ridleys is submerged aquatic vegetation, where abundant food sources are available. Evidence suggests that post-hatchling and small juvenile Kemp's ridleys utilize floating *Sargassum* as habitat in the North Atlantic Ocean for foraging while they are developing and maturing (NOAA/NMFS 2012a). An unknown portion of the population, made up of juveniles, can be found at inshore bays and estuarine habitats from Cape Hatteras, North Carolina to Cape Cod Bay, Massachusetts from July to November (NMFS 2001).

Juveniles migrate to developmental habitats along the U.S. Atlantic continental shelf from Florida to New England (Morreale and Standora 1998; NMFS and USFWS 2010; Peña 2006) at around two years of age when they reach a size of approximately 8 to 12 inches carapace length. Their migration occurs as the Gulf Stream warms to approximately 15°C, bringing the juvenile sea turtles to the New York area in late June or July (Morreale and Standora 1990). As the water warms, Kemp's ridley turtles continue to move northward up the coast or into Long Island Sound, where they forage throughout the fall (USACE 1994).

The New York Bight appears to be an occasional juvenile nursery area for the species, particularly in the Peconic Estuary, Gardiners Bay, and Block Island Sound (NMFS and USFWS 2007). Often, two- to five-year-old juveniles may be observed feeding on spider and green crabs in the eastern portion of the Bight in the warmer months, from June to October (Morreale and Standora 1990). Since the New York Bight supports a large proportion of the total Kemp's ridley population annually in their development cycle, this region is considered to be crucial to the existence of this sea turtle species.

Kemp's ridleys feed on shallow-water benthic invertebrates, with a preference for decapod crustaceans (i.e., crabs) and mollusks (Hildebrand 1982), but they are also known to prey on shrimp, fish, jellyfish, and plant material (Frick et al. 1999; Marquez-M. 1994). Habitats that Kemp's ridley turtles frequently use in U.S. waters are warm-temperate to subtropical sounds, bays, estuaries, lagoons, tidal passes, shipping channels, and beachfront waters (USFWS 2012). They often inhabit sheltered areas where their preferred food, the blue crab, is known to exist (Lutcavage and Musick 1985; Seney and Musick 2005).

Loggerhead Sea Turtle *(Caretta caretta)*

The loggerhead is the most common sea turtle in the New York Bight (Morreale et al. 1992). Loggerhead turtles are listed as threatened under the ESA. The Northwest Atlantic Ocean distinct population segment (DPS) of loggerhead sea turtles occurs along the continental shelf and in large bays, including New York Harbor, from July to November, as far north as Cape Cod Bay (NMFS 2001; Morreale and Standora 1998). Loggerheads can be found in a variety of habitats such as coral reefs, rocky bottoms, shellfish beds, and boat wrecks, commonly in waters shallower than 164 feet deep (Shoop and Kenney 1992). Adults can be found up to 34.5 nautical miles off of the south shore of Long Island. Densities of loggerhead turtles in the ROI are highest in the summer, followed by fall (NYDOS 2013). They are unlikely to occur in the ROI in winter or spring.

There are at least five demographically independent loggerhead nesting groups or subpopulations of the Northwest Atlantic Ocean DPS. Annual nesting totals of loggerheads on the U.S. Atlantic and Gulf coasts range between 47,000 and 90,000 nests, with an average of 70,880 nests from 1989 to 2007 (NMFS and USFWS 2009). NOAA Fisheries and USFWS issued a final rule on July 10, 2014 designating critical habitat for the Northwest Atlantic Ocean DPS and determined that no marine areas meeting the definition of critical habitat were identified within the North Pacific Ocean loggerhead sea turtle DPS. NOAA Fisheries and USFWS also designated specific areas in the terrestrial environmental of the U.S. Atlantic and Gulf of Mexico coasts as critical habitat for the Northwest Atlantic Ocean loggerhead sea turtle DPS (NOAA Fisheries 2014). However, no critical habitat was designated for the loggerhead turtle in the ROI.

Loggerhead sea turtles mate in late March to early June, and nest throughout the summer until early September. The primary Atlantic mating and nesting sites are along the east coast of Florida between St. Augustine and Jupiter, with some sites also in Georgia, the Carolinas, and the Gulf Coast of Florida (NRC 1990; NOAA/NMFS 2012a).

The diet of a loggerhead turtle varies by age class (Godley et al. 1998). Adult loggerheads are generalized carnivores that forage primarily on nearshore bottom-dwelling invertebrates (mollusks, crustaceans, sponges, and anemones) and sometimes fish (Dodd 1988). During migration through the open sea, they eat jellyfish, sea slugs, floating mollusks, floating egg clusters, flying fish, and squid. Primary components of the loggerhead's diet in the Long Island Sound, as well as Raritan Bay, include spider, rock, and horseshoe crabs (Burke et al. 1990).

Green Sea Turtle *(Chelonia mydas)*

Green turtles have a worldwide distribution and are typically found in areas with shallow depths and low wave energies (Mendonca and Erhart 1982). The green turtle is listed as two populations under the ESA: the Florida and Mexico Pacific coast breeding colonies; and sea turtles from all other populations. The Florida and Mexico Pacific coast breeding colonies are designated as endangered and all other colonies are designated as threatened (NMFS and USFWS 2007a). Critical habitat for green sea turtles includes the coastal waters of Culebra Island, Puerto Rico, and its outlying keys (NOAA/NMFS 2012a). The largest green sea turtle nesting population in the Atlantic Ocean occurs outside of the United States in Costa Rica, where between 17,402 and 37,290 females nest each year (Troëng and Rankin 2005). The greatest concentration of nesting within the United States occurs in Monroe County, Florida (Meylan et al. 1995).

Green turtles have occasionally been seen in nearshore waters from Massachusetts to Virginia, including the New York Bight, from July to November (NMFS 2001). Similar to the loggerhead and Kemp's ridley, green turtles move southward in late fall as water temperatures decline in Long Island Sound (USACE 1994).

Green turtles are highly migratory throughout their lives. Juveniles and subadults may travel thousands of nautical miles after settling into their nearshore developmental grounds before returning to breeding and nesting grounds (Mortimer and Portier 1989). Green turtles utilize three types of habitat: oceanic beaches (for nesting), convergence zones in the open ocean, and benthic feeding grounds in coastal areas. Between foraging and nesting sites, green sea turtles may migrate hundreds, or even thousands, of nautical miles each way due to a strong propensity for natal homing by adult females (NOAA/NMFS 2012a; NMFS 2012b). Nesting is usually restricted to tropical coastal areas, though nesting does occur on sub-tropical beaches of Florida. Adult green turtles mate every two to three years during the nesting season (NOAA/NMFS 2012a). Upon hatching on a beach, juveniles enter the water and move offshore.

During their first several years, juvenile green turtles remain offshore where they feed on pelagic plants and animals. After a number of years in the oceanic zone, they move to nearshore foraging grounds, where they become almost exclusively herbivorous (NOAA/NMFS 2012a), feeding on sea grasses or algae (Musick and Limpus 1997; Burke et al. 1992). However, some green turtles remain in the open ocean for extended periods, potentially never settling in coastal waters (NMFS and USFWS 2007b). The green turtle is the only species of sea turtle that primarily consumes plants and other types of vegetation (Mortimer 1995). Green turtles in the western North Atlantic, including Long Island Sound, feed primarily in areas of extensive sea grasses (USACE 1994). However, studies have shown that green turtles are opportunistic feeders that utilize available food sources; they may feed on jellyfish or sponges on rare occasions (Hildebrand 1982).

Leatherback Sea Turtle *(Dermochelys coriacea)*

The leatherback sea turtle, the world's largest living sea turtle, is listed as a single population and is classified as endangered under the ESA (NMFS and USFWS 1992a). Although the USFWS and NOAA Fisheries believe the current listing is valid, preliminary information indicates an analysis and review of the species should be conducted to determine the application of the DPS policy to leatherbacks (NMFS and USFWS 2007b). Critical habitat includes portions of the U.S. Virgin Islands, St. Croix, and is proposed for Puerto Rico.

Leatherbacks are common in the waters of the northeast United States from May through November. Leatherback sea turtles have been sighted on the continental shelf east of New Jersey and off Long Island’s south shore and their respective inshore waters, but they are relatively uncommon in and near the ROI (NMFS 2002).

Leatherback sea turtles are known to undertake extensive migrations, mostly within the temperate zone (USACE 1994). They occupy large, open bays in the northeast United States from June to November; the southern migration to Maryland and Virginia occurs in nearshore waters from August to November (NMFS 2001). Although considered an oceanic species, frequently descending to depths of 650 to 1,650 feet, leatherback sea turtles are sometimes found in waters as shallow as 197 feet (NMFS 1993).

The primary food sources of leatherback sea turtles are scyphozoan jellyfish and salps (USACE 1994). However, organisms such as larval fish and decapod crustaceans may also be ingested by leatherback sea turtles (Pritchard et al. 1983). The leatherback is the deepest diving sea turtle with a recorded maximum depth of 4,200 feet, though most dives are much shallower (usually less than 820 feet) (Hays et al. 2004; Sale et al. 2006).

The breeding grounds of leatherback turtles are located in the tropical and subtropical latitudes (Poland 1996). Nesting occurs from February to July on beaches as far north as Georgia but is generally limited to the Atlantic coast of Florida (NRC 1990). Since 1989, there has been a substantial increase in the nesting population along the east coast of Florida (Turtle Expert Working Group 2007). Little is known about the behavior and habits of neonatal and juvenile leatherback turtles.

Atlantic Sturgeon *(Acipenser oxyrinchus oxyrinchus)*

The Atlantic sturgeon is a long-lived, slowly maturing species, and may live up to 60 years. There are five DPS units of Atlantic sturgeon listed under the ESA: (1) the Gulf of Maine DPS is listed as threatened; (2) the New York Bight DPS; (3) Chesapeake Bay DPS; (4) Carolina DPS; and (5) South Atlantic DPS are listed as endangered (NMFS 2012c). No critical habitat has been designated for this species. While the proposed Project is located in the New York Bight, a sturgeon present in the ROI could be from any of the DPS locations. Within the New York Bight, the Atlantic sturgeon has been reported in the following river systems: the Hudson River (New York), the Taunton River (Massachusetts), the Connecticut River (Connecticut), and the Delaware River (New Jersey) (NMFS 2007).

Atlantic sturgeon would be expected to be a transient, foraging species within the ROI. Subadults and adults of this species typically live in coastal waters and estuaries when not spawning, in depths ranging between 35 and 165 feet in nearshore areas dominated by gravel and sand substrates (NMFS 2010a). Suitable substrate and depths for Atlantic sturgeon are present within the ROI. Data from the New York Bottom Trawl Survey from Montauk Point to New York Harbor did not capture Atlantic sturgeon in more than 66 feet of water (sampling was conducted up to a maximum of 115 feet) (Dunton et al. 2010). During this survey, most Atlantic sturgeon were captured between 16 and 33 feet offshore of the Rockaway area, approximately 7.0 nautical miles from Ambrose Channel.

During spawning years, adults migrate upriver in spring, beginning in April to May in the New York Bight (Dadswell 2006). After spawning, they migrate back into estuarine waters (NMFS 2010a). After one to 12 years of life, juveniles move downriver and occupy estuarine waters until they reach a size of 30 to 36 inches and move into nearshore coastal waters (NMFS 2010b), where they spend another 5 to 10 years before reaching sexual maturity (Stein et al. 2004). Tagging data indicate that immature Atlantic sturgeon disperse widely in nearshore waters throughout the Atlantic coast once they emigrate from their natal rivers (Secor et al. 2000).

The Atlantic sturgeon feeds along the bottom on benthic invertebrates such as polychaetes, oligochaetes, amphipods, isopods, mollusks, shrimp, and gastropods (NMFS 2010b; Gilbert 1989). It has also been documented to feed on fish (Bain 1997).

Roseate Tern *(Sterna dougallii)*

The North Atlantic population of roseate terns (*S. d. dougallii*) was listed as endangered under the ESA in 1987. Roseate terns are migratory seabirds that breed in both the Caribbean and North Atlantic, and winter along the northern and eastern coasts of South America (USFWS 2010). No critical habitat has been designated for the North Atlantic population of roseate tern (USFWS 2010). Roseate terns have a moderate likelihood of occurrence in the ROI as transients during migration.

Roseate terns have historically nested in coastal New York and New Jersey. The cause of roseate tern population decline in the North Atlantic is, in part, a result of impacts on the species that occurred prior to the 20th century and continued into the 1970s, as well as current threats (Gochfeld et al. 1998). Egging (harvesting of tern eggs for human consumption) during the late 19th century and early 20th century is thought to have significantly affected roseate tern colonies in the Atlantic (Gochfeld et al. 1998). In the mid and late 20th century, accumulation of organochlorines, including DDT (dichlorodiphenyltrichloroethane) and PCBs, in tern tissues and eggs (especially in New York and Massachusetts birds) is thought to have caused substantial declines in nest success (Gochfeld et al. 1998). Current threats to the species include habitat loss, nest predation, and increasing gull populations (USFWS 2010). Recent re-colonization of historic nesting sites indicate the North Atlantic roseate tern population may be recovering (USFWS 2010).

Roseate terns breed on small islands and barrier beaches from coastal New York north to Nova Scotia and Quebec (USFWS 1998). Roseate terns are colonial breeders, and nest on islands near or under cover, such as vegetation, rocks, driftwood, and even human-made objects. They have also been documented nesting on sand dunes found at the end of barrier beaches (USFWS 1998).

Roseate terns may migrate through the ROI in May, during northward migration. During southward migration, roseate terns are presumed to migrate well offshore, potentially passing through the ROI in late summer (Gochfeld et al. 1998). The species is rarely observed south of New Jersey (Gochfeld et al. 1998). The species' migration is compressed and may occur in as few as two to three days of autumnal migration from northern staging areas to southern staging areas (Nisbet et al. 2011). Roseate terns are expected to migrate far out over the OCS and they are known to fly in groups, which should limit the number of discrete instances of potential exposure risk to the proposed Project (Nisbet et al. 2011). Existing information on tern species' flight heights during migration indicate that migration may occur tens of meters above the water level (Perkins et al. 2004; Nisbet et al. 2011; Burger et al. 2011). Lower migratory flight heights during poor visibility or opportunistic foraging bouts are possible (Perkins et al. 2004; Nisbet et al. 2011). Terns are known to rest on the water, and may perch on floatsum and buoys.

3.4 Essential Fish Habitat

The Mid-Atlantic Fishery Management Council (MAFMC) used two methods for developing the EFH designation maps. The first method used the average catch rates per '10-minute square,' while the second method focused on percentages of observed range. The percentage of observed range method gathered data for all planktonic life history stages (eggs and larvae for most species, and juvenile and adult Atlantic herring) during NOAA Fisheries bottom trawl surveys and the Marine Resources Monitoring, Assessment, and Prediction (MARMAP) survey program. These data were used to develop the observed range for each species, which was based on species presence/absence for each in all '10-minute square' locations (NOAA/NMFS/NERO 2013).

EFH designation for highly migratory species is based on the movements and habitat use of these species. Ichthyoplankton surveys were used to delineate spawning and nursery grounds for highly migratory species. Feeding grounds vary on seasonal or temporal scales and are typically associated with water column features that coincide with upwelling, convergences zones, and other features.

The overlap of designated EFH for federally managed species and the ROI was determined using a database developed by NOAA, based on the presence/absence of species within 10-minute by 10-minute squares (NOAA/NMFS/NERO 2013). This same database is used by regional Fishery Management Councils to determine EFH in a FMP. EFH has been designated for 38 species in the ROI, including 23 bony fish, 10 sharks, two skates, one mollusk, and two bivalve shellfish. The life history stages for which EFH has been designated are listed in Table 3.4-1 and described in detail in Appendix E.

Table 3.4-1. Species with Designated EFH within the ROI of the Proposed Project

Habitat	Species	Lifestage Occurrence in the ROI			
		E	L/N	J	A
Benthic/ Demersal	Atlantic surfclam (*Spisula solidissima*)			X	X
	little skate (*Leucoraja erinacea*)	NA		X	X
	ocean quahog (*Artica islandica*)			X	X
	ocean pout (*Macrozoarces americanus*)	X	X		X
	pollock (*Pollachius virens*)			X	
	winter skate (*Leucoraja ocellata*)	NA		X	X

Habitat	Species	Lifestage Occurrence in the ROI			
		E	L/N	J	A
Water Column & Benthic/ Demersal	Atlantic sea herring (*Clupea harengus*)			X	X
	black sea bass (*Centropristis striata*)			X	X
	longfin squid (*Loligo pealeii*)			X	X
	monkfish (*Lophius americanus*)	X	X		X
	red hake (*Urophycis chuss*)	X	X	X	
	scup (*Stenotomus chrysops*)			X	X
	spiny dogfish (*Squalus acanthias*)	NA		X	
	summer flounder (*Paralichthys dentatus*)		X	X	X
	whiting/silver hake (*Merluccius bilinearis*)	X	X	X	
	windowpane flounder (*Scophthalmus aquosus*)	X	X	X	X
	winter flounder (*Pseudopleuronectes americanus*)	X	X	X	X
	yellowtail flounder (*Limanda ferruginea*)	X	X	X	X
Water Column	Atlantic butterfish (*Peprilus triacanthus*)	X	X	X	X
	Atlantic mackerel (*Scomber scombrus*)	X	X	X	X
	Atlantic salmon (*Salmo salar*)				X
	basking shark (*Cetophinus maximus*)	NA			X
	blue shark (*Prionace glauca*)	NA	X	X	X
	bluefin tuna (*Thunnus thynnus*)			X	X
	bluefish (*Pomatomus saltatrix*)			X	X
	cobia (*Rachycentron canadum*)	X	X	X	X
	common thresher shark (*Alopias vulpinus*)	NA	X	X	X
	dusky shark (*Carcharhinus obscurus*)	NA	X	X	
	haddock (*Melanogrammus aeglefinus*)		X		
	king mackerel (*Scomberomorus cavalla*)	X	X	X	X
	sandbar shark (*Carcharhinus plumbeus*)	NA	X	X	X
	sand tiger shark (*Carcharias taurus*)	NA	X		
	shortfin mako shark (*Isurus oxyrinchus*)	NA	X	X	X
	skipjack tuna (*Katsuwonus pelamis*)				X
	Spanish mackerel (*Scomberomorus maculatus*)	X	X	X	X
	tiger shark (*Galeocerdo cuvieri*)	NA	X	X	
	white shark (*Carcharodon carcharias*)	NA		X	
	witch flounder (*Glyptocephalus cynoglossus*)	X			

NOTE: Species lifestages for which EFH is designated are indicated by E = Eggs, L/N = Larvae (fish)/ Neonates (sharks), J = Juveniles, A = Adults. For simplicity, squid, which are usually categorized as pre-recruits and recruits, were grouped as juveniles or adults. If a lifestage does not exist for a species, it is indicated as NA.

3.5 Geological Resources

This section describes the geologic resources within the ROI for the proposed Project.

Geological resources consist of the surface and near-surface materials (i.e., rock and soil) of the Earth and the regional or local forces by which they are formed. These resources are typically described in terms of bathymetry, regional and local geology, soil resources, topography, mineral (paleontological, if applicable) resources, and geologic hazards. Bathymetry involves the geomorphic characteristics of the seafloor surface, including elevations, relationship with adjacent land features, and geographic location. Regional and local geological resources comprise Earth materials within a specified region and the forces that have shaped them, including bedrock or sediment type and structure, unique geologic features, the depositional or erosional environment, and age or history. Soil resources are unconsolidated terrestrial materials. As this proposed Project has a relatively small portion of these materials located on land, in previously disturbed soils, no soil resources are discussed here. Mineral and paleontological resources include potentially accessible geological materials with economic or academic value and significant artifacts. Geological hazards comprise the regional or local forces or conditions that could affect a proposed development or use (e.g., seismicity, liquefaction, slope stability, competency of bedrock, and subsidence or settlement). The geologic setting for the proposed Project, as described in the following sections, is based on available literature and on-site investigation.

The geologic events resulting in the formation of the Atlantic Basin and the continental shelf of eastern North America have a direct bearing on site geology, bathymetry, and/or geohazards potentially encountered by the proposed Project. Section 3.5.1 discusses the geology within the ROI and bathymetry within the ROI.

3.5.1 Regional Geology

The Atlantic Basin originated during the tectonically active break-up of the Pangaea Super continent during the Jurassic Period (approximately 200 million years ago [MYA]). The initial continental rifting formed a system of faults within the continental crust in parallel to the Appalachian Mountain chain and eventually developed into rift basins. Three inactive rift basins remain in the New York Bight region and are referred to as the Newark Basin, the Connecticut River Basin, and the Baltimore Canyon Trough and are presented in Figure 3.5-1. While these rift basins typically are inactive, current regional seismic activity often occurs in these old rifts. During subsequent geologic periods, these rift basins were largely filled with non-marine clastic and fine grained sediments often referred to as redbeds and lake deposits (Lore et al. 1999). The Baltimore Canyon Trough is still filling with terrestrially derived sediment in the region of the continental rise offshore of New York and New Jersey (USGS 2009).

As the rifting of the current Atlantic Basin continued, ocean water inundated the lower areas of the rifts developing into shallow seas. These shallow seas were periodically separated from the open ocean water, resulting in significant evaporation, allowing salt to concentrate and precipitate in thick layers. These layers have been encountered at great depth in the region offshore of the current shelf in the Baltimore Canyon Trough (Lore et al. 1999).

During the mid- to late-Jurassic Period, the nearby continents provided clastic (fragments of pre-existing minerals or rock) sediments to the continental shelf, largely transported in various river systems. During the Cretaceous (approximately 150 to 65 MYA), as the Atlantic Basin rifting continued, large stable carbonate platforms and extensive coral reef systems developed along the shelf edge margins (Stoffer and Messina 1996; Lore et al. 1999). Clastic sediments from the weathering of the Appalachian Mountain chain continued to dominate on the shelf westward of the coral reefs. During the Late Cretaceous and Early Tertiary (approximately 65 MYA), the clastic sediments were being deposited on top of the carbonate platform edge and into the deepwater basin region of the Atlantic Ocean (Stoffer and Messina 1996), resulting in the development of both carbonate and clastic bedrock lithology.

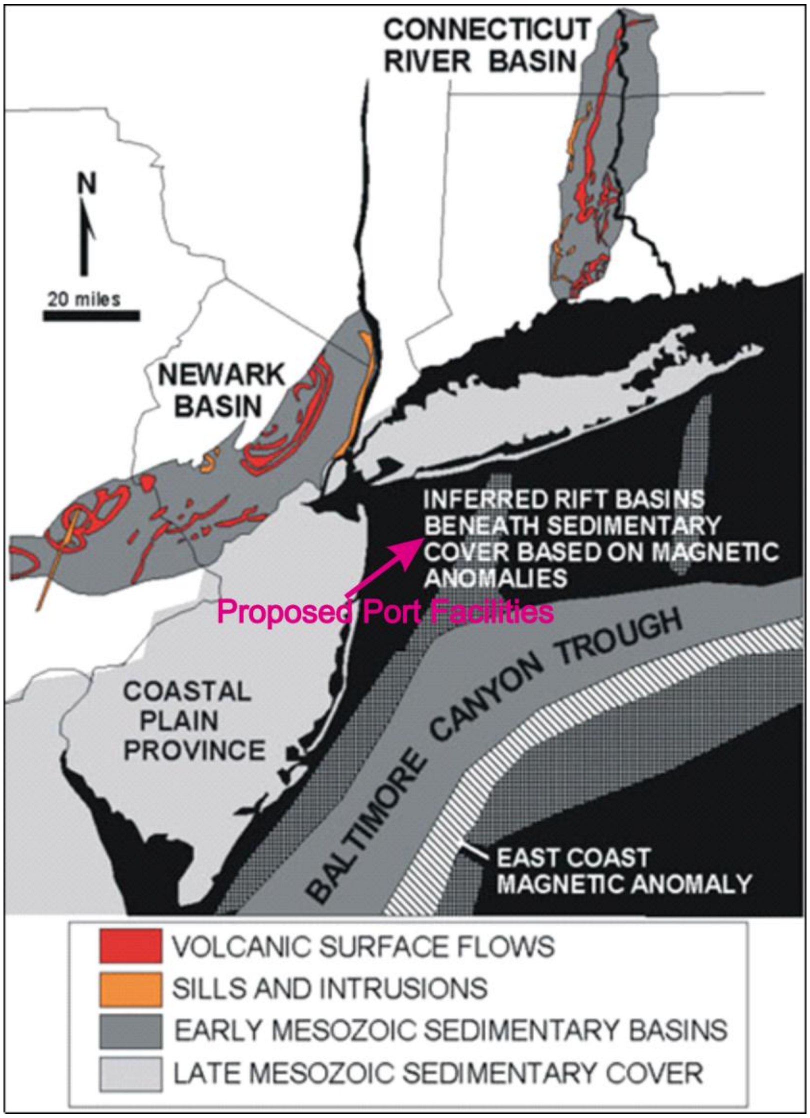

Figure 3.5-1. Relic Rift Basins Near the ROI
(USGS 2003)

During the Wisconsinan Glacial Period, approximately 15,000 to 18,000 years ago, sea level was around 300 feet lower than today (Plint et al. 1992), as much of the Earth's surface water was used in the formation of ice sheets. The coastline during this time was near the edge of today’s continental shelf. At this time, the continental shelf was no longer submerged and therefore became an erosional environment, bisected by fluvial systems flowing to the ocean. The Hudson Shelf Valley (sometimes called the Hudson Canyon) and Block Island Valley are relicts of this erosion and incision representing glacial river systems.

The glaciers formed during the ice ages generated and moved large amounts of clastic sediments outward from the continental interior toward the continental margins. Long Island itself originated as a glacial end moraine. Portions of the mass of sediment generated by glaciers were transported by surface processes (wind, rivers, coastal activity) into the ocean basin, resulting in a coarsening upward sequence in the stratigraphic column.

At the end of the glacial period, surface waters were released from the glacial system and sea levels rose, moving the focus of sediment deposition landward. River channels previously incised into the shelf now filled with sediment, and wave and tidal currents affected shelf sediments, winnowing out fines and redistributing sands and gravels in sand waves and ridges. Coarse lag deposits of sediments created during marine transgressions are preservable records of sea level change.

This on-going dynamic geologic process has resulted in a site stratigraphy in which a veneer of Quaternary (1.8 MYA to present) sediments directly overlie much older Cretaceous sediments (Schwab et al. 2002). From the early Holocene (10,000 years ago) to present, the sea level state has been one of marine transgression or rise, resulting in the drowning of the lower reaches of streams and rivers flowing into the Atlantic Ocean (Trapp 1992), and an ongoing infilling of the Hudson Shelf Valley and other features incised into the shelf with fine-grained silts and clays. This infilling of the previously incised valleys with fine marine sediments has resulted in their description as “mud holes.” Holocene sea level rise also has resulted in the formation of a modern transgressive ravinement surface over much of the New York Bight, characterized by sands and gravels distributed in sand waves and ridges of variable thickness.

Bathymetry

The coastal region of the eastern United States is part of the Atlantic Ocean basin. The Atlantic Ocean has a water surface area of approximately 36 million square miles, and holds approximately 80 million cubic miles of water (Pinet 1992).

This region is currently considered a tectonically passive continental margin dominated by sedimentary processes, which can be characterized by four main physiographic features identified as the continental shelf, continental slope, continental rise, and the abyssal plain.

The Atlantic continental shelf is submerged and gently ocean-sloping (as much as one degree). It was formed from terrestrial derived sediments and has been reworked by wave and tidal currents into ripple and wave-like bed forms. The shelf is approximately 61 nautical miles wide in the vicinity of the proposed Project (Stoffer and Messina 1996).

The continental shelf in the ROI is referred to as the New York Bight, where the shoreline curves or recedes westward at the New Jersey and New York state lines, and consists of a wide, shallow bay open to the Atlantic Ocean. Water depth in the New York Bight area typically ranges from 50 to 120 feet, with a maximum depth of 180 feet at the Hudson Canyon crossing.

The seaward edge of the continental shelf generally is defined as the line where there is a distinct break in the slope between one to more than 20 degrees with an average of about 4 degrees (Blatt et al. 1980). In the vicinity of the ROI, the break in slope is identified as being located approximately 300 feet beneath sea level (Maher 1971) east of the ROI.

The continental rise is a wedge of sediment that has accumulated at the base of the continental slope and inclines gently, normally less than half a degree, to the abyssal plains (Blatt et al. 1980). The abyssal plains are very flat regions of the ocean floor typically found at the base of the continental rise. Seismic profiling has shown that abyssal plains are formed of horizontal layers of very fine-grained sediment, primarily of terrestrial origin (Plummer et al. 2003).

3.5.2 Local Geology and Sediment Characteristics

The proposed Project would be positioned in the nearshore portion of the New York Bight. Much of this area was surveyed by the USGS from 1995 to 1998 using high resolution side-scan sonar and seismic reflection techniques along with sediment sampling (Schwab et al. 2000). Subsequent geophysical surveys and vibracore sampling by Ocean Surveys, Inc. (OSI) indicate unconsolidated, loose marine deposits (primarily sand and gravel) cover the seafloor in the ROI. In many places, the finer fractions of the Pleistocene glacio-fluvial sediments (silt and sand) have been winnowed away, leaving coarse lag deposits comprised mainly of gravel and cobbles, with some boulder-sized material.

The shallow subsurface is dominated by glacially derived materials that produce complex geology and exhibit a high degree of variability over short lateral distances. Seismic profiling suggests primarily sand with variable concentrations of gravel in the upper 10 feet. Layers of silt-clay may be present in places and interbedded with the sand. Vibracore samples have also revealed the presence of large shells and an abundance of shell fragments in the upper 15 feet that may be present locally.

In general, OSI (2012) classified the subsurface based on past and current seismic and actual surface samples:

- **Recent Marine Sediments (RMS):** primarily comprised of Holocene and reworked late Pleistocene materials including sand, gravel, silt, clay and shells; base of unit could be marked by coarse material up to 20 feet in thickness.
- **Glacial Drift (GD)**: inclusive of all sediments transported and deposited by glaciers, but in this case, refers to potential till (non-sorted, clay to boulders) and outwash (stratified, typically sand and gravel) deposits, formed during Pleistocene.
- **Glaciofluvial Deposits (GFD)**: fluvial sediments derived from glaciers and deposited in drainage pathways (meltwater stream channels) during the mid-late Pleistocene, often contain graded beds of sediment ranging from silt to gravel.
- **Coastal Plain Deposits (CPD)**: thick sequence of conformable beds with low southeasterly dip, research suggests composition is silt and sand units, possibly semi-lithified; late Cretaceous age.

In the vicinity of the proposed Port facilities, RMS overlies the thicker Pleistocene GD deposits. In some locations, possibly within the broad depression in the central portion of the proposed Port facilities, RMS are absent and underlying glacial materials outcrop in areas on the seafloor. RMS deposit thickness reaches its maximum of 15 to 20 feet in the northwest corner of the proposed Port facilities. Two Late Pleistocene GFD channels have been preserved in the near surface, representing relatively young meltwater pathways from the last glaciation as discussed in Section 3.5.1.

In comparison, a number of older, more extensive GFD exist in the thick Pleistocene sediment sequence that underlies the thin RMS surficial layer. These buried channels are wider and much more deeply incised, and in some cases cut into the underlying CPD. GFD channel fill consists of graded beds of sand, silt, gravel, and to a lesser degree estuarine deposits (clay to organic peat).

The Pleistocene GD sequence has two distinct seismic units: the upper unit is comprised of horizontally bedded sediments and the lower unit exhibits more structural variability as evidenced by the chaotic seismic signatures. The upper unit is interpreted as a predominantly depositional sequence formed at greater distances offshore from the ice front as part of the outwash plain, whereas the lower unit is believed to represent transitional sequences formed near the leading edge of the glacier, possibly deltaic in nature. Sand, silt, and clay are estimated to be the dominant sediment types in the upper unit with sand and gravel size material more likely in the lower Pleistocene deposit. Overall, the Pleistocene section of the stratigraphic column is thicker (60 to 85 feet) in the western half of the proposed Port facilities and thins eastward (less than 40 to 50 feet). The exception to this, in the eastern half of the proposed Port facilities, is where the buried channels cut deep into the coastal plain deposits. At the base of the Pleistocene strata, a coarse material layer is present that marks the unconformity eroded into the underlying coastal plain deposits.

A thick sequence of conformable, nearly horizontal strata underlies the entire ROI, as well as the New York Bight, and consists of CPD accumulated during the late Cretaceous. The coastal plain sequence is distinctive for its planar bedding that dips down slightly toward the southeast and its irregular upper erosional surface. The relationship of these geologic units can be seen in Figure 3.5-2.

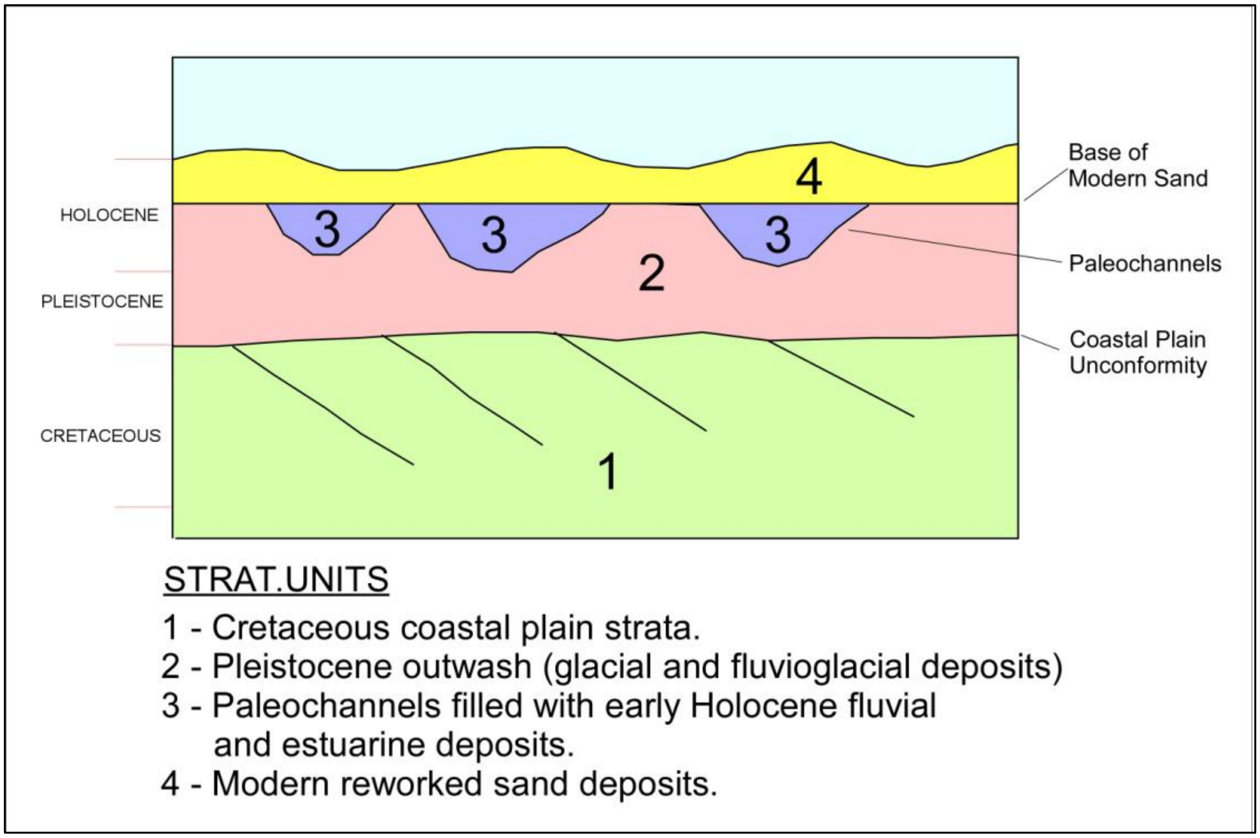

Figure 3.5-2. Stylized Geologic Cross-Section of the New York Bight
(OSI 2012)

Initiating from the interconnect with the existing Transco Lower New York Bay Lateral, the proposed Mainline route crosses the RMS, GD and GFD units. STL Buoy 1 and Lateral 1 are located on RMS fine sand ridges atop CPD strata. STL Buoy 2 and Lateral 2 are located mostly atop Holocene fine sands of the RMS sequence.

No hard-bottom was identified during geophysical surveys. Additional geotechnical evaluations in the area are proposed to be completed during 2015.

3.5.3 Geophysical Investigation

Multi-sensor geophysical surveys were conducted by OSI in 2012 in the ROI. Numerous offsets, cross lines, and optional alignments were covered along the proposed Mainline route and pipeline laterals to provide reconnaissance data in areas where potential issues may exist. The investigation was designed to provide pertinent data and results to characterize the seafloor and near surface geologic materials (approximately 200 feet wide in the construction corridor) for impacts from construction activities, and support the design and engineering of the STL Buoy systems. In addition, the investigation was used to identify and map natural and man-made features along with archaeological concerns.

3.5.4 Geologic Hazards

Potential geologic hazards generally include bathymetry (water depth), ground failure caused by unstable soils (slope instability), seismicity (earthquakes), shallow gas, gas hydrates, diapiric structures, volcanism, or human activities (mining and blasting). As discussed earlier in Section 3.5.1, the eastern coast of the United States is a passive tectonic margin compared to an active tectonic margin like the western coast of North America, which is subject to geologic uplift, volcanism and high levels of seismic activity. These hazards are summarized in Table 3.5-1 and discussed in detail below.

Table 3.5-1. Natural Subsurface Hazards Summary

Hazard	Definition	Identified / Description
Shallow faults, faulting attenuation	A fracture or fracture zone along which there has been displacement of the sides relative to one another, parallel to the fracture; attenuation is the translation of movement along a fault into surrounding mediums.	Present; subsurface expression of the New York Bight fault
Mass movement structures (slump, slide)	Often distinguished by a single coherent mass of material displaced from its original location, in which the sediment/rock mass remains virtually intact and moves outward and downward.	Not present
Diapiric structures	A type of intrusion in which a more mobile and ductily-deformable material is forced into brittle overlying strata; typically associated with massive mud or salt deposits at depth.	Not present
Shallow gas	Subsurface concentration of material in gaseous form that has accumulated by the process of decomposition of carbon-based materials (former living organisms, typically plants).	Not present
Buried channels	Formerly the deepest portion of a waterway filled in with sediment over time and preserved to some extent by sea level rise and depositional processes.	Present; relict drainage pathways both shallow and deep
Source: OSI 2012		

Bathymetry

The proposed Mainline route would avoid sand wave areas, but would cross an area of minor scour depressions in the vicinity of the interconnection with the Transco Lower New York Bay Lateral.

The inner portion of the New York Bight consists of multiple channels (217 nautical miles of established channels and berthing areas) that have been dredged for ship navigation, many deepened to almost 45 feet in the Upper New York, Raritan, and Newark Bays (Parkman 1983). In order to account for larger ships and long-term economic viability, the main shipping channels are being deepened to 50 feet under the direction of the USACE (2009) and is scheduled for completion by 2015 (USACE 2009). The proposed Mainline route would not cross any of these maintained channels.

Slope Instability

The seafloor within the ROI generally slopes to the southeast at gradients ranging from less than 0.05 degrees up to 0.47 degrees along the flanks of the shoals along the proposed Mainline route (OSI 2012). These slopes are very shallow. No evidence for slumping or mass movement of slopes occurring currently or in the recent geologic past were found in the shallow hazard surveys conducted by OSI in 2012.

Slope stability is dependent on the angle of the slope, and slope materials are largely consolidated. Therefore, large-scale failure of the seafloor would not be anticipated, but localized areas consisting of unconsolidated material could fail during excavation and construction. Geotechnical studies for the mooring system in the vicinity of the proposed facilities (to be performed in late 2014) and use of appropriate construction methodologies based on the results of these studies would avoid slope failure.

Seismicity

Minor faulting (called the New York Bight Fault System or Zone) is present in the ROI. This fault system is associated with ancient rifting within or near the Baltimore Canyon Trough. The fault system consists of vertical normal faults and is located offshore, approximately 7.8 nautical miles to the southeast of the city of Long Beach, New York, and approximately 16.7 nautical miles to the east offshore from New Jersey. The displacement on these faults of the system is downward and to the west (Hutchinson and Grow 1982; 1984).

The proposed Mainline route would cross the New York Bight Fault Zone between milepost (MP) 6.4 and MP 10. However, no surface expressions of faulting were observed in the near surface geophysical survey recently conducted along the proposed Mainline route.

The seismicity of the New York Bight area of the United States has been relatively stable over the past several hundred years. Earthquakes identified in the northeastern portion of the United States between 1638 and 1998 indicate few earth-damaging earthquakes in the vicinity of the New York Bight. Two large earthquakes with an estimated magnitude of 5.2 on the Richter Scale occurred in the New York Bight area in 1737 and 1884 (Wheeler et al. 2001). Most local earthquakes occur at a depth of approximately 6 miles.

The USGS Seismic Risk Map presented as Figure 3.5-3 identifies the ROI as a moderate risk zone (USGS 2008; FEMA 2010). However, damaging earthquakes in the New York-New Jersey area are rare (NJGS 2010). The recent 5.8 magnitude earthquake centered near Richmond, Virginia (2011) was only slightly felt with light damage in the New York-New Jersey area (USGS 2011).

Since no active faults were identified during the geophysical survey along the Mainline route and historical earthquake activity is minimal, risks to the proposed Project from fault activity would be expected to be minimal.

Shallow Gas

Shallow gas has been identified in the near-surface sediments along the continental margins of the eastern United States (Maine Sea Grant 2002). Gas that is trapped in the shallow sediments usually originates from deeper gas reservoirs, but can also come from biogenic activity in the shallow sediments themselves. Shallow gas-bearing zones are usually normally pressured. Shallow gas in near-surface sediments can cause seafloor instability and slope failure by affecting the shear strength of the sediments due to gas expanding within the pore spaces of the sediment. Drilling through these pockets from a fixed installation or jack-up is particularly hazardous. These shallow gas pockets are picked up as anomalies during geophysical sub-bottom profiling surveys. No shallow gas hazards were identified by the geophysical study (OSI 2012).

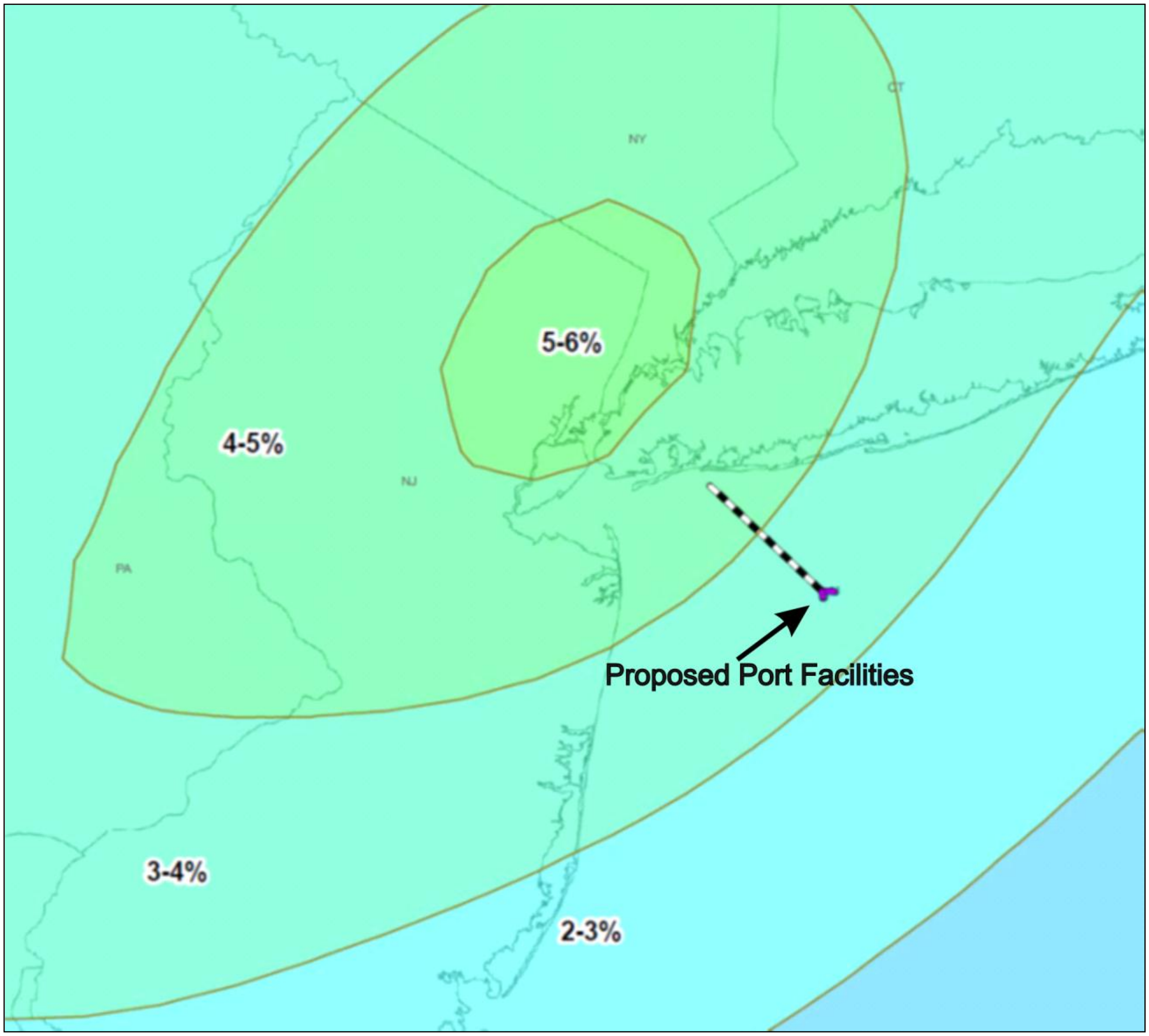

Figure 3.5-3. Seismic Risk Map

Gas Hydrates

Gas hydrate is an ice-like substance formed when methane or some other gases combine with water at appropriate pressure and temperature conditions. Gas hydrates sequester large amounts of low-molecular weight gas molecules, such as methane, and are widespread in marine sediments and sediments of permafrost areas. The Hydrate Stability Zone, where gas hydrates potentially occur, is located at depths of approximately 1,640 feet beneath the oceans (Boatman and Peterson 2000), much deeper than the depths in the ROI.

Gas hydrates that once provided support can dissociate quickly with slight changes in temperature and pressure, resulting in the seafloor slumping and sliding (Dillon et al. 1998). The failure of submarine slopes has long been linked spatially to the occurrence of hydrate- or gas-charged sediments and temporally to climate perturbations that destabilize gas hydrate zones.

Gas hydrates were not identified during the geophysical investigations and therefore would not be expected to occur within the ROI.

Diapiric Structures

Salt diapirs have been identified along the continental margins of the Atlantic Ocean basin. Salt diapirism is the upward flow of Jurassic salts due to a density differential with surrounding sediments. While an issue further offshore (the nearest identified diaper is 348 nautical miles to the southeast of the proposed Project location), they are not encountered in the sediments of the continental shelf province of the New York Bight.

Salt diapirs can act as traps for petroleum, but also can represent potential hazards, including activation of faults and fault scarps, slumping, and formation of shallow gas pockets, seeps, and vents.

Diapirism is not an issue of concern within the area. In addition, no shallow diapiric structures were identified by the geophysical study for the proposed Project.

Man-made Features/Paleontological Resources

Paleontological resources are the fossilized remains of prehistoric plants and animals, and the trace fossils left as indirect impressions of the form and activity of such organisms. These resources are considered to be non-renewable resources. Based on a review of available geologic data, no potentially significant fossils or sensitive paleontological resources are present within the vicinity of the proposed Project.

Shallow man-made features include shipwrecks, existing and relict electric and communication cables, unexploded ordnance and other anthropogenic objects. Shallow man-made features are identified in Table 3.5-2.

Table 3.5-2. Man-Made Features and Regulated Areas of Interest in the ROI

Route Crossing Location	Feature	Description
MP 3.1	Old telegraph cable	Out-of-service
MP 4.0-8.7	Outbound traffic lane	Ship traffic out of New York Harbor
MP 4.5	Territorial sea limit	12 nautical miles federal jurisdictional line
MP 6.1	Old telegraph cable	Out-of-service
MP 9.9	Old telegraph cable	Out-of-service
MP 11.2-13.6	Inbound traffic lane	Ship traffic into New York Harbor
MP 18.9	Old telegraph cable	Out-of-service
MP 19.3	Three nautical mile limit	State-federal jurisdictional line
MP 21.1	Neptune RTS cable system	In-service, two HVDC power cables and one fiber optic cable bundled
MP 21.4	Old telegraph cable	Out-of-service
MP 21.7	Transco Lower New York Bay Lateral (owned by Williams Co.)	In-service; planned tie-in point

3.5.5 Mineral Resources

Mineral resources are geologic material that are present in significant qualities to have anthropogenic economic or academic value. In the case of the Atlantic Basin, this could potentially include sand and gravel deposits as well as oil and gas deposits.

Sand and Gravel

The Bureau of Ocean Energy Management's (BOEM) Marine Minerals Program[1] provides policy direction and guidance for the development of marine mineral resources on the OCS. Minerals Management Service (MMS 2009) identified and evaluated five potential borrow areas in the New York Bight area for beach replenishment. The USACE New York District leases three offshore sand borrow areas from BOEM south of Long Island, New York. The three borrow sites are located in federal waters. Between MP 16.5 and MP 19.3, the Mainline route would run parallel to the western border of one of these federal sand borrow sites at a distance of approximately 0.7 nautical mile.

Oil and Gas

The North Atlantic Planning Area, consisting of 92 million acres of seafloor, lies offshore of the northeast part of the United States extending from Maine to New Jersey on the federal OCS. Eight exploratory wells and two Continental Offshore Strategic Test wells were drilled here but there are no active oil or gas leases in this area (MMS 2009).

Between 1976 and 1983, the MMS (now BOEM) conducted the first of 10 oil and gas lease sales along the eastern coast of the United States, resulting in the drilling of 51 offshore wells. Thirty-two wells were drilled; the majority of these wells were drilled in the Hudson Canyon area on the New Jersey continental shelf. Five of these test wells identified natural gas and/or condensate, but were abandoned as not being economical at the time (MMS 2009). The well data indicated that the Cenozoic rocks had poor reservoir and source rock characteristics, with low potential for petroleum hydrocarbons (Lore et al. 1999). The Mesozoic rocks did have the potential for large accumulations of petroleum hydrocarbons. Most likely these hydrocarbons are in the form of natural gas similar to those discovered in Mesozoic rocks offshore from Nova Scotia (Edson et al. 2000).

Beginning soon after in the mid-1980s, a moratorium on drilling off the eastern coast of the United States was in place until it expired in 2008. New lease sale plans made after this moratorium were cancelled in May 2010 following the Deepwater Horizon oil spill in the Gulf of Mexico. In December 2010, a ban on drilling in federal waters off the Atlantic coast was reintroduced through 2017.

3.5.6 Sediment Quality

Since the late 1800s, disposal of materials, such as industrial wastes, acid waste, municipal sewage sludge, cellar dirt, wood, and dredged material has occurred within the New York Bight area (Butman 2002). Hundreds of scattered piles of debris have been documented.

One of the largest areas of dumping is known as the Mud Dump Site. Between 1976 and 1995, approximately 6,000,000 cubic yards of dredged material was dumped in this area annually. It was closed as a disposal site in 1997. The site is now designated as a HARS approximately 9 square miles in size. A 3.3-foot-thick cap of clean dredged material currently is being placed over this area as part of remediation activities (Butman 2002). The hazard associated with disposal materials is that they are uneven and uncompacted, making them unstable and prone to slope failure. The proposed Project is approximately 8.6 nautical miles to the northeast of the HARS.

Sediment grab sampling was performed during the geophysical survey in 2012. The analysis of this survey is presented below in Table 3.5-3. The results indicated that the seafloor over most the ROI is mantled by medium sand.

[1] http://www.boem.gov/Marine-Minerals-Program/

Table 3.5-3. Sediment Grain Size Analyses from Surface Grabs Taken in New York Bight in the ROI

Sample	Approx. Milepost	% Gravel	% Sand	% Fines	Description of Predominant Sand Grain Size
Station 1	Approx. SSTI	0.20	98.53	1.270	medium
Station 2	Approx. SSTI	0.0	98.31	1.670	medium
Station 3A	MP 20.5	0.0	99.15	0.760	medium
Station 6A	MP 17.8	0.0	96.89	3.040	fine to medium
Station 8	MP 16.9	7.61	92.30	0.110	medium to coarse
Station 10	MP 14.8	2.90	97.04	0.0	medium to coarse
Station 12A	MP 12.7	0.0	99.77	0.250	medium
Station 14	MP 9.8	0.0	99.68	0.270	medium
Station 16	MP 7.5	0.0	99.75	0.320	medium
Station 18A	MP 5.8	0.0	99.96	0.0	medium
Station 20	MP 3.8	61.10	38.02	0.870	coarse to medium
Station 25	Near Buoy 2	0.90	83.40	15.700	fine to medium
Station 26	Near Buoy 2	0.0	99.95	ND	medium
Station 27	Near Buoy 2	0.0	99.85	0.140	medium
Station 28	Near Buoy 2	0.0	99.50	0.450	medium
Station 29	Between Buoys	18.70	77.00	4.270	fine to coarse
Station 30	Between Buoys	0.0	99.81	0.180	medium
Station 31	Near Buoy 1	1.72	95.72	2.540	medium
Station 32	Near Buoy 1	0.28	99.56	0.0	medium
Station 33	Near Buoy 1	0.0	99.76	0.150	medium
Source: OSI 2012 survey					

3.6 Cultural Resources

Cultural resources include archaeological sites (prehistoric and historic; terrestrial and marine), historic standing structures, objects, districts, traditional cultural properties and other properties that illustrate important aspects of prehistory or history or have important long-standing associations with established communities or social groups. Significant archaeological and architectural properties are usually defined by eligibility criteria for listing on the National Register of Historic Places (NRHP) and in consultation with the Office of Parks, Recreation and Historic Preservation (OPRHP), which functions as the State Historic Preservation Office (SHPO) in New York. SHPO sometimes requests the New York City Landmarks Preservation Commission to comment on cultural resources issues related to New York City. Projects that require federal permits or occur on federal lands require consultations by the federal agency, with SHPO, and interested Native American tribes under Section 106 of the National Historic Preservation Act (NHPA) of 1966 (as amended). As lead federal agency, the USCG would determine if the permitting of the proposed Project would adversely affect cultural resources that are listed in or potentially eligible for listing in the NRHP.

3.6.1 Cultural Resources within the Proposed Project Area

The area of potential effect (APE) for archaeology includes all marine locations that would undergo disturbance due to the proposed Project construction, operation, and decommissioning. The proposed Project consists of several components that have the potential to affect NRHP-eligible cultural resources.

The proposed Project would be located in areas that comprise portions of the Atlantic OCS and the coastal zone off New York. Prior to submersion by the rise of the sea level during the early Holocene, the OCS was exposed land surface available to Native American hunter-gatherers who may have lived seasonally in the area of the APE. As the OCS portions of the APE became submerged due to rising sea levels, Native Americans and later Euroamericans may have travelled the waters that are now part of New York Harbor during episodes of resource extraction, trade, and long- and short-distance travel. Remnants of various types of vessels, vessel fragments, and possibly other associated cultural items could be contained within the APE portions of the OCS and the coastal zone.

Two terrestrial locations: Port of Coeymans, New York and Quonset Point, Rhode Island have been tentatively identified as onshore facilities locations to be used for this proposed Project. However, reviews and site inspections of multiple sites in the Staten Island, New York area are underway, and selection of a suitable location is expected during the development stages. If any of the sites located on Staten Island are selected for the proposed Project, they would undergo an archaeological survey and be reviewed by the New York State Historic Preservation Office (NYSHPO). Onshore facilities would include a pipe staging and CWC facility; shore-based office and warehouse space for construction and operations; and support vessel staging area. The onshore locations would likely be facilities that are extant and that would undergo modification not involving new land disturbance. If the Port of Coeymans site would be selected as a staging area, Liberty would coordinate with NYSHPO and conduct archaeological surveys if needed. The staging area at Quonset Point, Rhode Island, has undergone a previous archaeological survey and review by the Rhode Island State Historic Preservation Office (RISHPO) and the Federal Energy Regulatory Commission (FERC). Both agencies concluded that use of the area would not affect any properties on or eligible for the NRHP (FERC letter, April 30, 2002, R. Hoffmann, FERC, to P. Hester, M&N Management Company and S. Tillman, Algonquin Gas Transmission Company).

3.6.2 Cultural Context

The OCS portion of the APE was a previously exposed landscape that extended during the last glacial period for about 64 nautical miles east and 86 nautical miles south of the present New York and New Jersey shorelines. During the Pleistocene era, sea level was roughly 328 feet lower than today (Merwin and Bernstein 2003), making now-inundated landscapes available for land-based fauna and flora. Bones of fossil walrus, mammoth, mastodon, and ground sloth have been recovered from this former landscape sporadically during dredging activity (Hayward et al. 2000).

The oldest sites documenting human activity in proximity of the APE are Paleo-Indian sites (ca. 12,000 – 8,000 years before present [BP]) (Chesler 1982). Associated diagnostic artifacts include fluted points usually made of high-quality stone material. Archaeologists believe that fluted points served as spear points used for hunting and that large game such as mastodon may have been the focus of hunting activity. The Port Mobil site contained stone artifacts, including fluted points, scrapers, knives, and cores, distributed within three loci on a bluff overlooking the Arthur Kill. Two additional Paleo-Indian sites were also recorded on Staten Island, one immediately north and one south of Port Mobil (Kraft 1977). These data attest to the presence of Paleo-Indian groups in the region and to the potential for additional Paleo-Indian sites within the now-submerged OCS former landscape.

The archaeological record indicates that as the environment transitioned to more modern conditions, bringing gradual changes in climate, flora and fauna, human populations responded with different tool types and seasonal cultural adaptations. The Archaic period (ca. 8,000 – 3,000 BP) (Chesler 1982) succeeded the Paleo-Indian period, represented by distinctive varieties of stone tools that developed over time. The Archaic period is subdivided into Early, Middle, and Late subperiods, each represented by distinctive tool types and recognized patterns of site location. Areas that are now submerged were at one time exposed land when the sea level was lower. At that time, there were prehistoric hunter-gatherers that used these formerly upland landscapes and possibly left remnants of their activities in archaeological sites. These sites are now within OCS sediments and, as glaciers melted, sea levels rose and areas that were exposed uplands became submerged. While sea levels were rising gradually, portions of the OCS were still available upland landscapes during the Archaic period as documented by stone tools, typical of the Early and Late Archaic subperiods, discovered in OCS sand that had been dredged about 1.6 nautical miles east of Sandy Hook in 46 feet of water just west of the Hudson Canyon.

The Woodland period (ca. 3,000 – 1,000 BP) follows the Archaic period and is represented by further technological changes in stone tools and such innovations as pottery and some use of domesticated plants. Climatic and archaeological data suggest that few post-Archaic period land-based sites would be found submerged in OCS settings. Woodland and later Contact period sites are cultural adaptations to essentially modern sea level conditions, which have been extant since about 3,000 to 4,000 ago.

It is possible that any vessels that may have been used following the Archaic period to modern day could potentially be represented in the archaeological record in the submerged APE. The proposed Project would be located within the Atlantic Ocean approaches to the Port of New York and New Jersey, one of the busiest harbors and transportation centers in the United States. The Port of New York and New Jersey has been busy throughout the historic period with ship traffic. Vessel types included canoes, sloops, schooners, clipper ships, steamships, transatlantic ocean liners, barges, and tankers. Commercial vessels, small and large, and recreational vessels could also be represented.

3.6.3 Existing Conditions

Cultural resources assessment of the proposed Project APE within state and federal waters was performed. Background research identified previously recorded sites of shipwrecks and other obstructions within and in the vicinity of the proposed Project. Geophysical data were collected generally following BOEM guidelines for archaeological surveys. A subsequent geotechnical coring program was implemented to ground truth and correlate geophysical survey records. Twelve of 43 cores were collected and subjected to further testing to assist archaeological analyses of potential paleo-landforms (Schmidt et al. 2012; Ryberg et al. 2012). The search for shipwrecks and submerged landforms was accomplished with a remote sensing array that included marine magnetometer, side-scan sonar, a sub-bottom profiler, and an echosounder. These methods record anomalous magnetic, acoustic, and shallow seismic signatures. The spatial distribution and/or patterning of results and the amplitude and duration of magnetic anomalies provide the basis for interpreting the collected information. The identification of potentially significant cultural resources involves pattern recognition from a suite of attributes.

Paleo-landforms that have the potential to contain prehistoric-period archaeological sites were evaluated through the placement of vibracores in targeted locations. Twelve cores were collected to assist archaeological analyses of potential paleo-landforms and to identify natural levee environments based upon sedimentological parameters that could have supported past human populations.

State Waters

Background research indicated that a total of nine shipwrecks and obstructions have been charted within 0.9 nautical mile of the proposed Project Mainline route within New York state waters. One wreck, the Iberia, was identified as to name while six were identified as to vessel type (unnamed barges clustered around the northern edges of the Atlantic Beach Fish Haven, composed of deliberately discarded large-scale objects ranging from subway cars and vessels to architectural debris). Other Automated Wreck and Obstruction Information System (AWOIS) notations for obstructions include an entry identified as a sunken fishing vessel (Schmidt et al. 2012).

Twelve targets were identified based on geophysical investigations and initially recommended for avoidance within the construction corridor.

Federal Waters

Remote sensing data identified 13 targets that have the potential to be significant cultural resources. It has been recommended that these targets be avoided by the proposed Project or that they be evaluated to determine if they are historic vessels and if they meet the criteria to be eligible to the NRHP.

Geophysical analysis identified three paleochannels with potential to contain formerly upland archaeological sites. Upon detailed analysis of cores from these locales, the paleochannels proved not to possess characteristics indicative of potentially significant submerged cultural resources.

3.7 Ocean Uses, Land Uses, Recreation, and Visual Resources

3.7.1 Ocean Uses

The proposed Project would be located in New York waters for approximately 2 nautical miles and within federal OCS waters for approximately 16.8 nautical miles in the apex of the New York Bight off the coasts of New York and New Jersey. The New York Bight is an important economic area that supports commercial shipping, the Port of New York and New Jersey, cruise ship and passenger ferry transits, commercial fishing, offshore sand borrow and disposal areas, submerged infrastructure, MPAs, and artificial reefs. The existing conditions of each of these ocean uses and resources are described in the following sections and illustrated in Figure 3.7-1.

3.7.1.1 Commercial Shipping

The New York Bight is an important economic area and navigable waterway that falls under the jurisdiction of the USACE. Under Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403), the USACE oversees the creation of any obstruction that may affect the navigable capacity of any waterway in the United States, as well as the safety of vessel traffic and emergency spill response.

The International Maritime Organization (IMO) has three established Traffic Separation Schemes (TSS) in the New York Bight to regulate vessel traffic through the busy waterway. Each TSS consists of an inbound and outbound shipping lane, a separation zone, and precautionary areas (Figure 3.7-1) to allow commercial vessels to safely navigate to the Port of New York and New Jersey. Commercial ship traffic is directed to use the TSSs while approaching or departing the New York Harbor to prevent collisions. The three TSSs, from north to south, are the Nantucket to Ambrose/Ambrose to Nantucket Traffic Lanes, Hudson Canyon to Ambrose Traffic Lane/Ambrose to Hudson Canyon Traffic Lanes, and the Barnegat to Ambrose/Ambrose to Barnegat Traffic Lanes. Precautionary areas are located at the offshore and inshore limits of each TSS. Smaller commercial and recreational vessels do not necessarily use the TSSs and can be found throughout the New York Bight. The proposed Port facilities would be located in the open waters between the Ambrose to Nantucket Traffic Lane and the Hudson Canyon to Ambrose Traffic Lane. The proposed Mainline would be installed beneath the Nantucket to Ambrose/Ambrose to Nantucket Traffic.

The Deepwater Port Act require the establishment of a zone of appropriate size around and including any deepwater port for the purpose of navigational safety. In such zone, no installations, structures, or uses are permitted that would be incompatible with the operation of a deepwater port.

The USCG has promulgated regulations that provide requirements for the establishment of, restrictions, and location of safety zones, no anchoring areas (NAAs), and areas to be avoided (ATBAs) around deepwater ports (33 CFR 150 Subpart J).

As set forth in the application, the proposed Safety Zone would have a radius of 1,640 feet from the center of each STL Buoy, encompassing a combined area of approximately 388 acres or 0.6 square mile (Figure 2.1-12).[2] All unauthorized vessels would be prohibited from anchoring or transiting the proposed Safety Zone at any time.

[2] As a matter of practice, if an LNG carrier is present and on the buoy, the USCG would extend the Safety Zone by a distance equivalent to the length of the LNG carrier (approximately 984 feet in length) to account for weathervaning (rotation) of the vessel around the STL Buoy, a distance of approximately 2,624 feet.

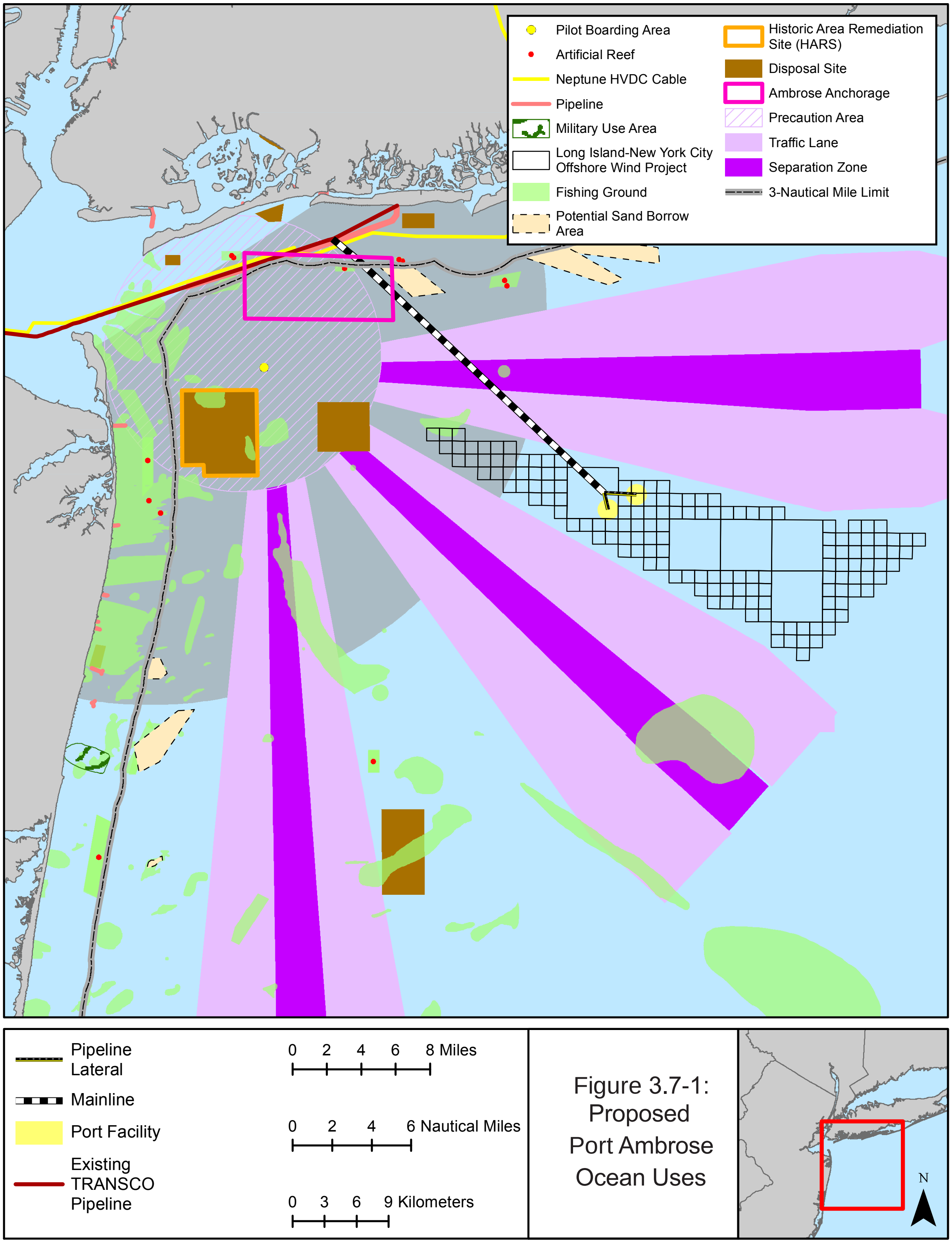

Figure 3.7-1. Proposed Port Ambrose Ocean Uses

In addition to the Safety Zone, NAAs and the ATBA are proposed to be established.[3] As set forth in the application, the proposed NAAs and the ATBA would be the same size with a radius of 3,281 feet measured from the center of each STL Buoy.[4] This would be approximately 1,552 acres or 2.4 square miles around each buoy (Figure 2.1-12).

Both the NAAs and the ATBA would appear on subsequent editions of local and regional nautical charts. No vessels would be allowed to anchor in the NAAs to prevent damage to the STL Buoy and mooring system or damage to the Port's equipment from entanglement. The restriction would likely also apply to bottom trawling. The ATBA is meant to discourage vessel traffic. It would help ensure that other vessels do not interfere with the deepwater port's operations, including the maneuvering of the LNG carrier and its support vessels. Both the NAAs and the ATBA are normally recommendatory.

LNGRV traffic would be coordinated by Liberty personnel (Figure 2.1-13).

3.7.1.2 The Port of New York and New Jersey

The Port of New York and New Jersey is made up of a group of ports in southern New York and northern New Jersey, including Port Newark, the Elizabeth-Port Authority Marine Terminal, the Howland Hook Marine Terminal, the Brooklyn-Port Authority Marine Terminal, the Red Hook Container Terminal, and the Port Jersey Port Authority Marine Terminal. Commercial vessels transit the ROI to access these ports using the TSSs. The Port of New York and New Jersey is the largest port on the East Coast and the third largest port in the United States. In 2012, the Port of New York and New Jersey handled 5.5 million 20-foot equivalent units (TEUs) and traded a total dollar value worth over $210 billion (PANYNJ 2013b). Further information on the socioeconomics of the Port of New York and New Jersey is provided in Section 3.8.

3.7.1.3 Cruise Ships and Passenger Ferries

The Port of New York and New Jersey contains three cruise terminals including the Manhattan Cruise Terminal in Manhattan, New York; Cape Liberty Cruise Port in Bayonne, New Jersey; and the Brooklyn Cruise Terminal in Brooklyn, New York. Nine cruise lines call to these terminals. Nearly 300 cruise trips were scheduled for these terminals in 2013. Most of the trips were scheduled for July to September (99 trips) followed by October to December (85), April to June (68), and January to March (39). Most of the trips would travel south to the Caribbean (NYCruiseInfo 2013).

The New York Harbor has two public ferry terminals (one in Staten Island and one in Manhattan) to service the Staten Island Ferry and at least 23 private ferry terminals (13 in New Jersey, four in Manhattan, and six in Brooklyn and Queens) owned by Circle Line Downtown, Circle Line Sightseeing Cruises, the Trust for Governors Island, Liberty Landing Ferry, New York Waterway, New York Water Taxi, Seaport Liberty Cruises, Seastreak, and Statue Cruises. Most of the ferries service locations in and around Manhattan, although some service locations in central New Jersey (Atlantic Highlands/Sandy Hook/Belford), Connecticut (Bridgeport, New London), and Massachusetts (Martha's Vineyard) (NYCDOT 2013). The ferry routes are within the New York Harbor and along the coastline and would not cross through the ROI.

3.7.1.4 Commercial Fishing

Commercial fishing vessels from Maine, Massachusetts, Rhode Island, Connecticut, New York, and New Jersey travel to the New York Bight to fish. This section focuses on commercial fishing vessels with homeports in New York and New Jersey, because in more recent years, due to the increase in fuel costs

[3] NAAs and ATBAs are established by the International Maritime Organization pursuant to a request from the U.S. Government. If approved, each zones' specific boundary would be set forth via regulation.

[4] Past practice has been that ATBA's have a radius of at least 820 feet longer than that of the NAA for appropriate stand-off which would occupy an area of 1,213 acres around each buoy.

and decrease in searching for fish, vessel captains were able to maximize catch and profit at locations closer to their homeport. In 2011, 354 vessels in New York and 506 vessels in New Jersey had permits on record with NOAA Fisheries. A total of 4,731 commercial permits were on record with NOAA Fisheries for the Northeast in 2011 (NOAA Fisheries 2013a).

Commercial fishing of ground fish species, pelagic fish species, and invertebrate fish species is an important economic activity within state and federal water off the coasts of New York and New Jersey (see Section 3.8.1.1). Six of the top 10 fishing ports in the Mid-Atlantic in 2010 by landed weight and landed volume were in New York or New Jersey. The top commercial fishing ports in New York are Montauk and Hampton Bay-Shinnicock and the top fishing ports in New Jersey are Cape May-Wildwood, Atlantic City, Point Pleasant, and Long Beach-Barnegat (NOEP 2013).

NOAA Fisheries provides commercial catch and trip data for offshore locations by dividing the offshore waters into statistical areas, quadrants, and blocks. Each statistical area spans one degree and is divided into four 30-minute quadrants, which is divided into nine 10-minute blocks. The proposed Port facilities would be located in Regional Statistic Area 612, Quadrant 2, Blocks 44 and 45, and the proposed Mainline route would be located in Regional Statistic Area 612, Quadrant 2, Blocks 23, 33, 34, and 44. Area 612 includes the waters of the apex of the New York Bight (see Figure 3.7-2).

Commercial fishing trips and landings data for the location of the proposed Port facilities is provided in Table 3.7-1. Commercial fishing trips and pounds landed vary greatly within Blocks 44 and 45. The number of fishing trips ranges from 10 to 84 in Block 44 and from 11 to 797 in Block 45 from 2000 to 2008. The pounds landed ranges from 19,435 to 300,000 in Block 44 and from 18,968 to 1,248,572 in Block 45. There is no clear pattern to the numbers recorded for each. The number of commercial fishing trips and pounds landed in Area 612 are more consistent each year. The number of commercial trips ranges from 14,090 to 16,272 and pounds landed ranges from 14,910,903 to 35,457,874.

Table 3.7-1. Commercial Fishing Trips and Pounds Landed for Blocks 45 and 45 and Area 612 From 2000 to 2008

Year	Commercial Fishing Trips			Pounds Landed		
	Block 44	Block 45	Area 612	Block 44	Block 45	Area 612
2000	84	11	15,318	218,407	18,968	20,332,925
2001	26	23	15,032	36,677	1,248,572	22,664,575
2002	57	71	15,355	300,000	183,131	29,287,239
2003	26	68	15,194	47,002	146,721	25,875,599
2004	10	31	15,488	19,435	93,075	15,552,281
2005	54	75	14,090	50,036	150,994	14,910,903
2006	71	287	14,451	153,688	364,650	35,457,874
2007	58	159	16,272	184,5751	188,131	18,355,177
2008	63	797	14,107	41,293	1,211,956	28,288,994
Average	50	169	15,034	116,810	400,690	23,413,952
Source: NOAA Fisheries 2011						

Due to depth, preferred habitat, and gear types used, the top targeted species varies within each of the blocks of Area 612. The top commercial species, by weight, caught in Block 44 in 2008 were loligo squid (20,040 pounds) and winter flounder (9,055 pounds). The top commercial species, by weight, caught in Block 45 in 2008 were sea scallops and shells (1,109,072 pounds), goosefish (48,575 pounds), and summer flounder (20,388 pounds). Block 44 only represents 0.52 percent of the weight of the total catch of Area 612 for the top 11 targeted species in 2008 (excludes hand line, since that gear is not considered a major gear type). Block 45 represents 16.3 percent of the weight of the total catch of Area 612 for the top 11 targeted species in 2008 (NOAA Fisheries 2011).

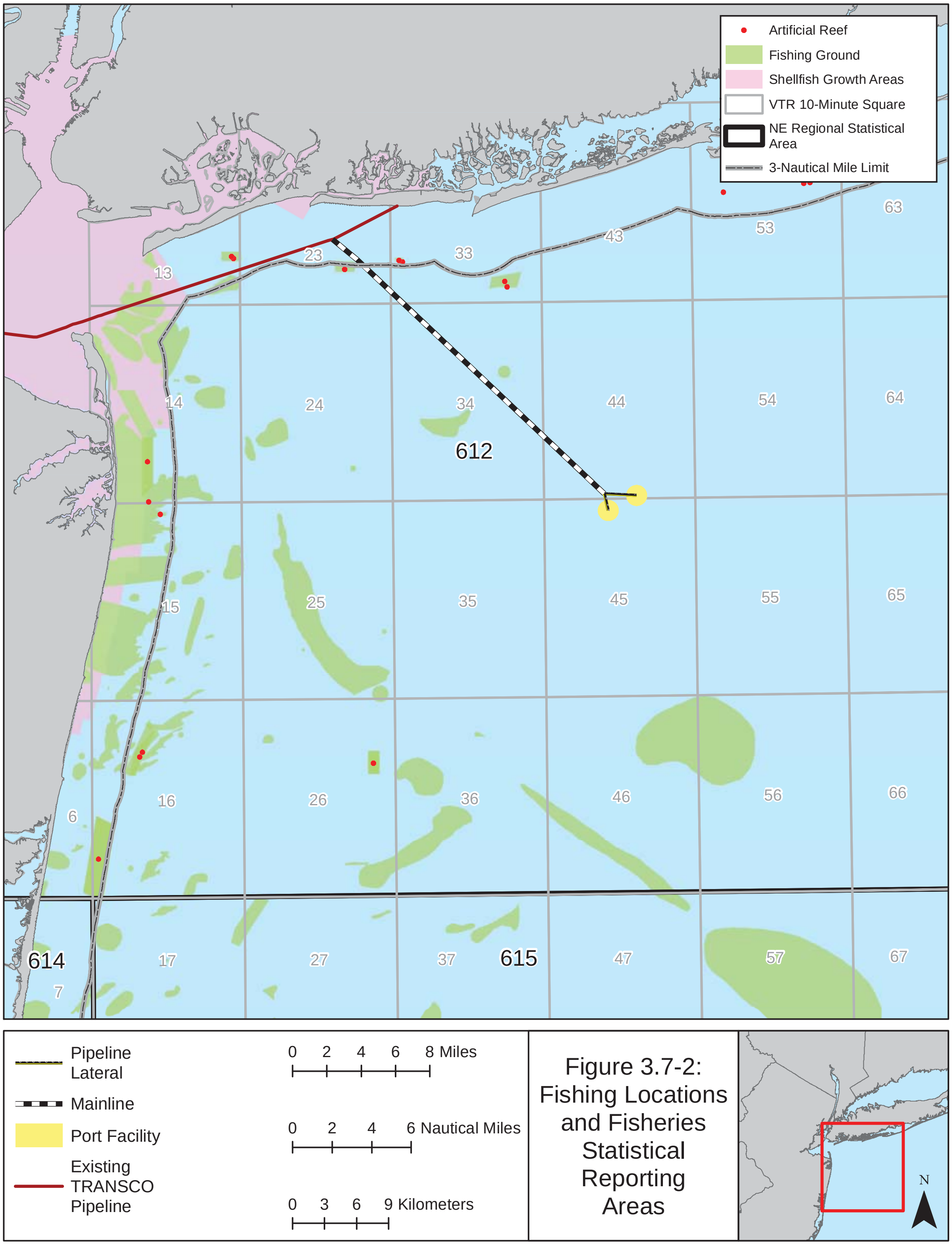

Figure 3.7-2. Fishing Locations and Fisheries Statistical Reporting Areas

Gear types used by commercial fishermen in the ROI include bottom and mid-water otter trawls, scallop dredges, lobster and conch pots, and sink or drift gill nets. Otter trawls are the most commonly used gear types in Blocks 44 and 45. Otter trawls and scallop dredges were used in both of the blocks; however, total pounds caught were significantly higher in Block 45. Lobster and conch pots, gill nets, and sinks were used in Block 45 but were not used in Block 44. Commercial fishing grounds are mostly concentrated around the coastline and reefs (Figure 3.7-1). A concentration of marked fishing grounds exists near the Atlantic Beach Reef and around the northwestern extent of the Mainline route near its interconnection with the existing Transco Lower New York Bay Lateral. For more information, see Section 4.2.4 for fisheries resources, Section 4.4 for EFH, and Section 4.8 for economic data related to commercial fishing in the ROI.

3.7.1.5 Military Use

The USCG Sandy Hook Station in Highlands, New Jersey and the Earle Naval Weapons Station, Earle/Leonardo Pier complex in northern New Jersey on the southern coast of Sandy Hook Bay are located west of the proposed Port facilities.

3.7.1.6 Offshore Sand Borrow and Disposal Areas

Offshore sand borrow areas are locations that BOEM has authorized the extraction of sand, gravel, or shell resources from the OCS outside of state jurisdiction for shore protection, beach or wetlands restoration projects, or construction projects. The USACE New York District has three leases for offshore sand borrow areas from BOEM. The Mainline route from MP 16.5 to MP 19.3 would be approximately 0.6 nautical mile southwest of the closest sand borrow area (Figure 3.7-1). See Section 3.5.5 for more information on the sand borrow areas.

Ocean dumping has occurred in the New York Bight for over a century. Materials that have been dumped in the area include dredge materials, construction materials, garbage, municipal sewage sludge, cellar dirt, and other similar materials. Federal legislation now prohibits dumping and the disposal sites have been closed. The disposal site closest to the proposed Project charted by NOAA is an acid dump site approximately 5.0 nautical miles southwest of the Mainline route and 11.6 nautical miles west of the proposed Port facilities (Figure 3.7-1).

3.7.1.7 Submerged Infrastructure

As many as six undersea cables would be crossed by the Mainline. One of the cables, the Neptune high voltage direct current (HVDC) transmission cable that connects Sayreville, New Jersey to Nassau County, New York, is currently in-service (Figure 3.7-1). The Mainline route would cross this cable at MP 21.2. The four (one crossed twice) out-of-service NOAA-charted communication cables are believed to be old telegraph cables laid in the early 1900s. The Mainline route would cross these cables at MPs 3.1 and 6.0 (two crossings of the same utility), 9.9, 18.9, and 21.5.

3.7.1.8 Artificial Reefs

The NYSDEC develops artificial reefs to increase fisheries habitat, provide shelter and foraging opportunities for marine fish and other organisms, and increase productivity in the areas where they are placed. Artificial reefs are popular for commercial and recreational fishing and self-contained breathing apparatus (scuba) diving. Artificial reefs are made of rock, concrete, rubble, and steel in 11 locations off the coast of New York (two reefs in the Long Island Sound, two in Great South Bay, and seven in the Atlantic Ocean off the south shore of Long Island) (Figure 3.7-1).

The Atlantic Beach and the Fishing Line artificial reefs would be located closest to the Mainline route. The Atlantic Beach Reef is 0.6 nautical mile west of the Mainline at MP 19 and is 413 acres (2,000 yards by 1,000 yards) at a depth of 55 to 64 feet. Fishing Line Reef, which is also referred to as McAllister Grounds, is 2.0 nautical miles east of the Mainline route at MP 20 and is 115 acres (925 yards by 600 yards) and 50 to 53 feet deep. The next two closest artificial reefs are Hempstead Reef (5.7 nautical miles east of MP 20) and Rockaway Reef (5.6 nautical miles west of MP 18) (NYSDEC 2013a).

3.7.1.9 Renewable Energy Projects

The Long Island-New York City Offshore Wind Collaborative, which is made up of the New York Power Authority (NYPA), the Long Island Power Authority (LIPA), and Con Edison, has proposed to develop the Long Island-New York City Offshore Wind Project in the Atlantic Ocean approximately 13 nautical miles off the Rockaway Peninsula. The commercial offshore wind energy facility would be designed for 350 megawatts (MW) within a 127-square mile lease area and would have the potential to expand to 700 MW (Figure 3.7-1). The proposed wind energy project is located within this lease area. The proposed wind energy project is currently undergoing feasibility assessments and pre-development activities and has yet to seek proposals from private development firms to build the proposed wind energy project and to enter into power purchase agreements (LI-NYC Offshore Wind 2013).

3.7.2 Land Uses

Onshore facilities proposed as part of this proposed Project include:

- Pipe staging and CWC facility for fabrication and construction of the proposed Port;
- Shore-based office and warehouse space for construction;
- Shore-based office and warehouse space for operation; and
- Support vessel staging area for construction and operation.

At this time, Liberty has not identified specific locations for these facilities. Liberty has indicated that the selected locations would be capable of supporting the construction and operation activities with the appropriate size, location, accessibility, infrastructure, and availability. Existing third-party facilities selected by Liberty would manufacture the facility components. Potential land use impacts resulting from this proposed Project would be avoided by contracting existing manufacturing companies.

Sites at Quonset Point in North Kingstown, Rhode Island and Port of Coeymans in Coeymans, New York are being considered for the pipe staging and CWC facility. Quonset Point is managed by the Quonset Development Corporation and is intended to provide sites for industrial development, offices, education, and marine industry, to create new job opportunities for Rhode Island workers, and to be sensitive to the built and natural environment. The Port of Coeymans has an extensive history as an industrial working waterfront. Selection of a specific site is anticipated during the development stages of the proposed Project. The selected site must have adequate space for the plant, field offices, and heavy equipment storage and use, a pier for raw material delivery via barge, and water and electrical supply.

One or more locations would be selected for the shore-based office and warehouse space during construction of the proposed Project for logistics support site for materials and personnel transfers, warehousing and storing of proposed Project material, rigging of equipment, and offices for the various construction management teams. The sites must have a construction warehouse and waterfront dock space that meet Project-specific criteria of water depth, crane capacity, and proximity to the worksite. The shore-based office and warehouse space for construction would likely be selected from existing facilities with similar uses within the New York City, Staten Island, or Long Island areas. No specific locations have been identified at this time.

Shore-based office and warehouse space for operations would be leased at a location with existing facilities and similar uses to support operation of the Port. No specific locations have been identified at this time.

A support vessel would be on call to support proposed Port operations and would be staged at existing onshore facilities with existing infrastructure required for the vessel. In addition, the support vessel would conduct weekly inspections of the surface components of the Port and would make approximately one trip per LNGRV arrival from a base of operation on the Mainland.

3.7.3 Recreation Resources

3.7.3.1 Recreational Boating and Fishing

The New York and New Jersey coasts are popular recreational boating and fishing destinations for surf fishing and deepwater fishing aboard private boats and party/charter boats. On average, over 5 million people in New York and over 6 million people in New Jersey have participated in recreational fishing from shore, party or charter boats, or private or rental boats each year from 2003 to 2012 (Table 3.7-2; NOAA Fisheries 2013b). The most popular recreational fishing mode is from private or rental boats followed by party or charter boats.

Table 3.7-2. Participation in Recreational Fishing from Shore, Party or Charter Boat, and Private or Rental Boat in New York and New Jersey from 2003 to 2012

Year	Shore	Party or Charter Boat	Private or Rental Boat	Total
		New York		
2003	2,089,522	405,533	3,030,068	5,525,123
2004	1,754,330	388,507	2,669,695	4,812,532
2005	2,495,006	526,773	3,107,041	6,128,820
2006	1,960,509	361,086	3,120,198	5,441,793
2007	2,522,254	683,576	3,315,311	6,521,141
2008	2,340,802	387,657	3,199,199	5,927,658
2009	1,624,649	381,129	2,818,553	4,824,331
2010	1,674,998	348,145	2,350,952	4,374,095
2011	1,389,389	458,285	2,320,371	4,168,045
2012	1,460,113	347,313	1,848,065	3,655,491
Average a/	**1,983,495**	**437,855**	**2,881,265**	**5,302,615**
		New Jersey		
2003	2,711,223	465,975	3,602,089	6,779,287
2004	2,120,544	432,395	3,895,242	6,448,181
2005	2,356,888	452,333	3,752,512	6,561,733
2006	2,682,045	632,637	3,720,950	7,035,632
2007	2,978,571	605,290	3,614,369	7,198,230
2008	2,857,490	448,947	3,595,050	6,901,487
2009	2,234,261	433,977	2,671,080	5,339,318
2010	2,278,494	319,766	3,264,644	5,862,904
2011	2,334,132	383,019	2,446,119	5,163,270
2012	2,037,218	313,197	2,549,801	4,900,216
Average a/	**2,505,961**	**463,815**	**3,395,784**	**6,365,560**

a/ 2012 data are preliminary estimates. Only final estimates (2003 through 2011) are included in the average calculation.

Recreational fishing catch in New York and New Jersey include bluefish, cod, hake, drum, flounder, mullet, porgy, puffers, sea bass, triggerfish, wrasse, and other cartilaginous fish (NOAA Fisheries 2013b). The majority of total recreational fishing catch in New York and New Jersey has occurred in inland locations over the past decade (Table 3.7-3; NOAA Fisheries 2013b). The second greatest catch was from locations in state waters less than or equal to 3 nautical miles from shore. This area includes most of the artificial man-made reef structures that are part of the NYSDEC Marine Fishing Reefs Program that become fish havens and popular recreational and commercial fishing destinations. Project facilities are located in areas popular for recreational fishing (NYDOS 2013). However, a relatively small amount of recreational fishing in New York and New Jersey occurs in federal waters greater than 3 nautical miles from the coast where the proposed Port facilities would be located.

Table 3.7-3. Recreational Fisheries Total Catch Inland, Less Than or Equal to 3 Nautical Miles, and Greater Than 3 Nautical Miles from Shore in New York and New Jersey from 2003 to 2012

Year	Inland	Less Than or Equal to 3 Nautical Miles	Greater Than 3 Nautical Miles	Total
New York				
2003	15,201,829	7,296,422	1,214,333	24,643,151
2004	14,369,074	7,012,698	923,661	22,305,430
2005	12,329,443	8,578,248	2,650,147	23,557,840
2006	13,962,342	8,613,045	1,294,340	23,869,727
2007	14,468,619	7,950,949	1,521,513	23,941,078
2008	15,155,027	9,408,582	597,478	25,161,088
2009	14,841,598	5,388,729	910,334	21,140,661
2010	13,611,880	5,853,176	462,417	19,927,472
2011	10,978,320	6,497,017	328,596	17,810,640
2012	12,268,313	5,852,659	180,921	18,301,896
Average a/	**13,879,792**	**7,399,874**	**1,100,313**	**22,484,121**
New Jersey				
2003	15,060,371	9,355,995	7,648,018	32,064,383
2004	9,390,866	13,640,730	8,654,653	31,686,250
2005	18,517,729	8,015,263	5,778,652	32,311,646
2006	16,301,741	6,956,422	5,574,306	28,832,471
2007	13,987,163	9,209,085	5,589,427	28,785,680
2008	22,516,685	10,907,482	3,755,624	37,179,789
2009	12,405,122	8,541,572	5,045,681	25,992,380
2010	12,819,243	10,293,118	5,086,954	28,199,312
2011	13,050,332	7,897,249	1,833,816	22,781,397
2012	15,680,846	9,411,194	4,175,357	29,267,401
Average a/	**14,894,361**	**9,424,102**	**5,440,792**	**29,759,256**
a/ 2012 data are preliminary estimates. Only final estimates (2003 through 2011) are included in the average calculation.				

3.7.3.2 Whale Watching and Sea Life Tours

Whale watching and sea life tours are offered out of New York and New Jersey during the summer months when whale species are off of Long Island to feed. Tours are offered through the Coastal Research and Education Society of Long Island, Inc. (CRESLI) at Dowling College (Oakdale, New York), Viking Fleet (Montauk, New York), and American Princess Cruises (Breezy Point, New York) (CRESLI 2013; Viking Fleet 2013; American Princess Cruises 2013). New Jersey whale watching and sea life tours originate out of southern New Jersey. American Princess Cruises would be the only whale watching company that has the potential to cross through the ROI. The ROI contains areas known to be used for other types of wildlife viewing (NYDOS 2013).

3.7.3.3 Scuba Diving

Within the New York Bight, scuba diving occurs primarily at shipwrecks and artificial reefs during months with warmer weather and water temperatures. Artificial reefs are discussed in Section 4.7.2, and shipwrecks, which are the most popular diving attraction, are discussed in Section 4.6.

3.7.3.4 Shoreline Activities

Fishing, swimming, camping, picnicking, wildlife watching, among other activities, are popular sources of recreation along the Long Island coastline. The proposed Port would be located approximately 16.1 nautical miles off of Jones Beach, New York and 27.1 nautical miles from the entrance of New York Harbor. Visual resources are described in in Section 3.7.4.

3.7.4 Visual Resources

The Mainline route and the STL Buoys would not be visible because the Mainline would be installed below the seafloor and the STL Buoys would be lowered to a landing pad on the seafloor approximately 103 feet deep and would remain there until retrieved by an LNGRV. The LNGRVs, which are expected to deliver LNG to the STL Buoys 45 times each year, would be the only visible component of the proposed Project.

Saratoga Associates prepared a project-specific Visual Impact Assessment (VIA) (Appendix G) that objectively evaluates the potential visibility of the proposed Project (Saratoga Associates 2012). The VIA evaluates potential visual impacts from locations within 21.7 nautical miles of the proposed Port facilities, which is a conservative estimate of the distance at which the LNGRV would no longer be visible due to the curvature of the Earth. The onshore locations within 21.7 nautical miles of the proposed Port facilities include shoreline areas of Nassau County and western Suffolk County, New York. These locations are highly populated with numerous beaches and waterfront recreation areas that are popular for tourism and recreation during the summer months. The eastern portion of this shoreline area contains barrier islands that are made up of undeveloped park land, including Jones Beach and Robert Moses Beach State Parks. The western portion of this shoreline area is developed with single- and multi-story residential buildings, public boardwalks, and commercial development in the City of Long Beach, Point Lookout, Lido Beach, and Atlantic Beach.

Viewer groups from these onshore locations include local residents, vacationers, and day-use recreational users who visit for the scenic, recreational, social, and cultural resources of Long Island’s southern shore. Views from onshore locations toward the proposed Project include a nearly unbroken stretch of open ocean that contains vessels ranging from small non-motorized recreational vessels to large oceangoing vessels, which are frequently visible from shore. The existing offshore visual conditions from onshore viewpoints are provided as Figures 4A through 4D in Appendix G.

Offshore viewers include local residents, vacationers, and day-use recreational users, as well as through travelers aboard vessels. Views from offshore locations include open ocean with vessels ranging from small non-motorized recreational vessels to large oceangoing vessels with stretches of land in the background. Offshore views include the Nantucket to Ambrose/Ambrose to Nantucket Traffic Lanes, which are 7.8 to 12 nautical miles from Long Island and used by large oceangoing and commercial vessels.

3.8 Socioeconomics

Socioeconomics include the basic aspects and resources that characterize the human environment. Our analysis of offshore activity focuses on commercial fishing, recreational fishing, marine-based tourism and recreation, marine commerce and shipping, and OCS resources. Onshore, the analysis focuses on populations and demographics, housing, employment and income, and recreation and tourism.

Socioeconomic impacts would be expected to occur in the New York counties closest to the proposed Project, since these counties are expected to be utilized for onshore construction and operations support and would be the primary source of the workforce to the extent feasible. The onshore area of the ROI is defined as the counties of Richmond (Staten Island), Kings, Queens, Nassau, and Suffolk in New York. These counties were selected based on proximity to the proposed Project, because they are likely to be utilized for onshore construction and operation support.

Local, county, and state data was used to identify the baseline socioeconomic conditions of the potentially affected area. Data describing characteristics such as race, ethnicity, and poverty levels were used to assess onshore demographic and population trends. Economic data, such as unemployment, the distribution of employment by industry, and sources of government revenue, were used to establish baseline socioeconomic trends in economic growth, income, employment, and the housing market. Identification of these trends facilitates an assessment of potential impacts from construction, operations, and decommissioning of the proposed Project.

3.8.1 Offshore Economic Conditions

A 2011 study by A. Strauss-Wieder, Inc. on the economic impact of the New York New Jersey Port Maritime Industry found that in 2010, the port industry supported 170,770 direct jobs, $11.6 billion in personal income and $37.1 billion in business income, making the New York New Jersey Port a global hub of trade of commerce with direct local impact. The 2011 study focused on 12 counties in New York, 15 counties in New Jersey and four counties in Pennsylvania and provides data on a regional level as well as state-by-state.

The National Ocean Economics Program (NOEP) provides county-level data and information for market, non-market, natural resources, population and housing, ports and cargo, and government expenditures for locations along the U.S. coast, Great Lakes, and coastal waters. The NOEP ocean economy dataset includes data on the major sectors of the ocean economy, including marine construction, living resources (i.e., fishing, fish hatcheries, seafood markets, and seafood processing), offshore minerals (i.e., limestone, sand, gravel, oil, and gas), ship and boat building and repair, tourism and recreation (i.e., amusement and recreation services, boat dealers, eating and drinking places, hotels and lodging places, marinas, recreational vehicle parks and campgrounds, scenic water tours, sporting goods retailers, and zoos and aquariums), and transportation (i.e., deep sea freight, marine passenger, and search and navigation equipment). An establishment is included in an industry whose definition explicitly ties the activity to the ocean or is located in an industry that is partially related to the ocean and is located in a shore-adjacent zip code. The number of establishments and the employment, wages, and gross domestic product (GDP) provided by these establishments are provided in Table 3.8-1.

Table 3.8-1 demonstrates the importance of the ocean economy in the New York and New Jersey counties in the vicinity of the proposed Project in terms of employment, wages, and GDP. The following sections discuss several aspects of the ocean economy, including commercial fishing, recreational fishing, marine-based tourism and recreation, marine commerce and fishing, and OCS resources.

Table 3.8-1. Summary of Ocean Economy (2010)

County	Number of Establishments	Employment a/	Wages ($) a/	GDP ($) a/
Kings County, NY	2,570	17,924	385,164,188	804,664,894
Nassau County, NY	1,204	12,961	284,499,760	572,923,627
Queens County, NY	1,008	8,843	206,533,326	391,026,815
Richmond County, NY	710	7,212	152,680,402	311,578,275
Suffolk County, NY	2,113	24,812	730,176,265	1,493,933,943
Middlesex County, NJ	331	9,231	405,671,581	757,959,409
Monmouth County, NJ	1,250	14,325	285,186,315	540,896,490
Ocean County, NJ	1,175	12,176	228,436,604	435,161,662
a/ NOEP 2010				

3.8.1.1 Commercial Fisheries

As discussed in Section 3.7.1.4, commercial fishing vessels from Maine, Massachusetts, Rhode Island, Connecticut, New York, and New Jersey travel to the New York Bight to fish. This section focuses on commercial fishing vessels with homeports in New York and New Jersey because in more recent years, due to the increase in fuel costs and decrease in searching for fish, vessel captains were able to maximize catch and profit at locations closer to their homeport.

The proposed Port would be located at least 8.7 nautical miles from identified commercial and recreational fishing grounds within the area, including Cholera Bank, Middle Grounds, Angler Bank, Mussel Ridge, Atlantic Beach Reef, Fishing Line Reef, and Hempstead Town Reef. Several commercial and recreational fishing grounds are located within approximately 5.2 nautical miles of the Mainline route, including Atlantic Beach Reef, which is located approximately 300 yards west of the Mainline and Fishing Line Reef, which is located approximately 0.4 nautical mile east of the Mainline.

Six of the top 108 commercial fishery ports by landings value in the United States listed by NOAA Fisheries are located in New York and New Jersey. Vessels departing from Long Beach-Barnegat and Point Pleasant Ports would be most likely to cross through the ROI due to their locations in relation to the proposed Project and the Atlantic Ocean. In 2011, the Long Beach-Barnegat Port, ranked 36th while landing 8.9 million pounds worth $33.8 million, and the Point Pleasant Port, ranked 43rd while landing 15.3 million pounds worth $26.8 million (NOAA Fisheries 2011). Information for these commercial fishing ports and the other four ports in New York and New Jersey is included in Table 3.8-2.

Table 3.8-2. Commercial Fishery Landings by Port of New York and New Jersey by Dollars (2011)

Port	Millions of Dollar (Rank) a/	Millions of Pound (Rank) a/
Cape May-Wildwood, NJ	102.7 (6)	39.5 (27)
Long Beach-Barnegat, NJ	33.8 (36)	8.9 (64)
Point Pleasant, NJ	26.8 (43)	15.3 (50)
Montauk, NY	18.8 (53)	13.0 (55)
Atlantic City, NJ	17.3 (57)	22.7 (37)
Hampton Bay-Shinnicock, NY	7.4 (93)	6.3 (8)
a/ NOAA Fisheries 2011		

3.8.1.2 Recreational Fisheries

Commercial and recreational fishermen target similar species and use many of the same fishing grounds. Differences in the commercial and recreational fishing industries are in catch per unit effort, spatial distribution of fishing activity, gear type, catch strategies, fishing duration, vessel type, habitat and bathymetry, and species regulations and limits. Additional recreational fishing information is provided in Section 3.7.3.1.

Local economies benefit from recreational fishing through expenditures, including equipment and license sales, food/restaurants, and lodging. The National Survey of Fishing, Hunting and Wildlife-Associated Recreation has been conducted since 1955 and is one of the oldest and most comprehensive continuing recreation surveys. The survey documents the number of recreational anglers, hunters, and wildlife watchers, as well as how often they participate, and how much money they spend on these activities in the United States. The most recent survey was conducted in 2011. Table 3.8-3 includes survey results for the 2001, 2006, and 2011 surveys.

In New York in 2011, approximately 801,000 state residents and nonresidents 16 years and older participated in saltwater fishing activities, which accounted for 43 percent of the total fishing activities, including saltwater and freshwater. Saltwater fishing expenditures in New York totaled $882,063,000. Of that amount, $114,855,000 was food and lodging-related and $442,740,000 was from equipment. A total of 10,054,000 trips were conducted from New York for saltwater fishing in 2011 (USFWS 2013a). In New Jersey in 2011, approximately 604,000 state residents and nonresidents 16 years and older participated in saltwater fishing activities, which accounted for 79 percent of the total fishing activities including saltwater and freshwater. Saltwater fishing expenditures in New Jersey totaled $671,050,000. Of that amount, $111,192,000 was food and lodging-related and $238,857,000 was from equipment. A total of 6,197,000 trips were conducted from New Jersey for saltwater fishing in 2011 (USFWS 2013b). Table 3.8-3 identifies a growing trend in the number of participants and trips, as well as trip-related expenditures related to saltwater fishing in New York and New Jersey in the past decade.

Table 3.8-3. Recreational Fishing in New York and New Jersey

Survey Year	State Residents and Nonresidents 16 Years and Older who Participated in Saltwater Fishing Activities	Trip and Equipment-Related Expenditures ($)	Number of Trips
New York			
2001 a/	406,000	190,914,000	3,856,000
2006 b/	291,000	307,004,000	3,013,000
2011 c/	801,000	882,063,000	10,054,000
New Jersey			
2001 d/	572,000	343,817,000	4,562,000
2006 e/	496,000	552,151,000	4,860,000
2011 f/	604,000	671,050,000	6,197,000

a/ USFWS 2003a d/ USFWS 2003b
b/ USFWS 2008a e/ USFWS 2008b
c/ USFWS 2013a f/ USFWS 2013b

Fishing licenses are not required for fishing in marine and coastal district waters or tidal waters of the Hudson River, Delaware River, or Mohawk River and their tributaries. These anglers must enroll in the no-fee recreational marine fishing registry. Similarly, all anglers must register through New Jersey's no-fee Saltwater Recreational Registry Program before fishing in New Jersey waters. New York and New

Jersey registered anglers are automatically enrolled in the NOAA Fisheries nationwide federal registry and may fish in federal waters without paying the $15 federal registry fee imposed in 2011 (NYSDEC No Date and NJDEP 2013).

Party charter boats, larger vessels that transport a sizeable number of people to specific fishing grounds and/or natural and artificial submarine structures nearshore and offshore to harvest by hook and line, are another aspect of the recreational fishing industry in the ROI. The Mainline route would be located approximately 300 yards to the northeastern corner of the Atlantic Beach Reef. Fishing Line Reef is located approximately 0.4 nautical mile east of the Mainline and Hempstead Town Reef is located within 3.2 nautical miles of the Mainline. These artificial reefs enhance fishery resources and habitat and provide recreational fishing and scuba diving opportunities.

3.8.1.3 Marine-Based Tourism and Recreation

Marine-based tourism and recreation includes marinas, artificial reefs and diving, and wildlife watching. Table 3.8-4 includes the number of establishments and statistics on employment, wages, and GDP for marine-based tourism and recreation in New York and New Jersey.

Marinas

There are numerous locations and opportunities for marine and saltwater recreational fishing in New York. The following is a summary of marine fishing access points in the five-county study area:

- Richmond County – 16 fishing locations, 8 of which have a boat launch
- Kings County – 17 fishing locations, 4 of which have a boat launch
- Queens County – 39 fishing locations, 7 of which have a boat launch
- Nassau County – 10 boat ramps/marinas
- Suffolk County – 64 boat ramps/marinas

There are also numerous private marinas located in the region with access to the New York Bight and the proposed Project area.

Table 3.8-4. Marine-Based Tourism and Recreation Employment, Wages, and GDP

County	Number of Establishments a/	Employment a/	Wages ($) a/	GDP ($) a/
New York				
Amusement and recreation services	715	5,799	141,714,082	261,604,608
Boat dealers	162	738	29,213,633	66,165,618
Eating and drinking places	15,236	202,644	4,619,856,005	9,850,264,807
Hotels and lodging places	679	42,127	2,114,953,221	6,127,033,542
Marinas	247	1,522	54,709,435	126,416,283
Recreational vehicle parks and campsites b/	35	-	-	-
Scenic water tours	87	184	6,420,500	10,314,710
Sporting goods retailers	15	119	7,186,721	20,828,164
Zoos, aquaria	54	736	42,386,607	97,942,107

County	Number of Establishments a/	Employment a/	Wages ($) a/	GDP ($) a/
New Jersey c/				
Amusement and recreation services	333	1.987	38,912,852	56,184,470
Boat dealers	100	559	20,819,300	47,721,690
Eating and drinking places	5,884	63,246	1,075,135,595	2,057,350,219
Hotels and lodging places	666	10,230	262,753,360	556,753,603
Marinas	193	959	34,661,101	77,641,039
Recreational vehicle parks and campsites	37	411	14,443,703	30,605,065
Scenic water tours	70	257	6,876,272	11,139,892

a/ NOEP 2010
b/ Recreational vehicle parks and campsites information in New York could not be disclosed.
c/ Sporting goods retailers and zoos/aquaria information in New Jersey could not be disclosed.

According to the New York State Recreational Boating Report (2012), New York ranks 7th in the United States for the number of registered boats. The number of vessels registered in 2012 in the five-county study area is reported as follows:

- Richmond County – 3,821
- Kings County – 4,436
- Queens County – 6,588
- Nassau County – 30,889
- Suffolk County – 67,038 (New York State 2012)

According to the Marine Trades Association of New Jersey's Recreational Boating Report (2008), there has been a substantial decrease in the number of vessels registered in New Jersey since 2000, despite an increase in the number of vessels registered within the United States. The number of vessels registered in 2008 for the counties in the vicinity of the proposed Project is reported as follows, with Oceana and Monmouth counties accounting for 25 percent of the state's registered boats:

- Middlesex County – 3,821
- Monmouth County – 4,436
- Ocean County – 6,588 (Marine Trades Association of New Jersey 2008)

Artificial Reefs and Diving

As discussed in Section 3.7.1.8, NYSDEC maintains artificial reefs to increase fisheries habitat and provide marine fish and other organisms additional opportunities for shelter and foraging, which may increase productivity in the areas where they are located. There are currently 11 artificial reef sites in New York that are managed by the NYSDEC Marine Artificial Reef Program. As discussed in Section 3.7.1.8, the Mainline route would be located in close proximity to several artificial reefs.

In addition to artificial reefs, there are also several shipwrecks located off the coast of Long Island that attract recreational divers. As with recreational fishing, numerous scuba diving companies provide charters for these activities. In addition to economic benefits from charter rentals, scuba diving also supports onshore services such as instructions and classes, dive clubs, and equipment shops/service.

Artificial reefs are discussed in Section 4.7.2, and shipwrecks, which are the most popular diving attraction, are discussed in Section 4.6.

Wildlife Watching

The National Survey of Fishing, Hunting and Wildlife-Associated Recreation, discussed in Section 3.8.1.2, includes data on participation in wildlife watching, which includes activities such as feeding, observing, or photographing wildlife. Table 3.8-5 summarizes the impact of wildlife watching in New York and New Jersey and reveals the importance of the industry to the New York and New Jersey economies. In 2011, a total of $659,871,000 was spent on trip-related expenditures for wildlife watching in New York and a total of $228,123,000 was spent in New Jersey. The number of state residents and nonresidents 16 years and older who participated in nonresidential wildlife watching activities has remained above one million for the state of New York and over 600,000 for the state of New Jersey since 2001.

Table 3.8-5. Wildlife Watching in New York and New Jersey

Survey Year	State Residents and Nonresidents 16 Years and Older who Participated in Nonresidential Wildlife Watching Activities	Trip-Related Expenditures ($)	Number of Trips
New York			
2001 a/	1,330,000	248,174,000	12,606,000
2006 b/	1,293,000	695,724,000	10,708,000
2011 c/	1,157,000	659,871,000	9,059,000
New Jersey			
2001 d/	688,000	142,042,000	6,522,000
2006 e/	615,000	146,300,000	7,350,000
2011 f/	605,000	228,123,000	6,210,000
a/ USFWS 2003a b/ USFWS 2008a c/ USFWS 2013a	d/ USFWS 2003b e/ USFWS 2008b f/ USFWS 2013b		

Offshore wildlife watching includes seal and whale watching excursions that are offered by numerous organizations and charters. A popular location for seal watching walks is Jones Beach State Park, located 16.1 nautical miles from the ROI, where walks are offered from January to April. Whale watching tours typically depart from Montauk and either travel near the east end of Long Island or north to Martha's Vineyard from July through Labor Day. Tours traveling along the east end of Long Island come within 60+ nautical miles of the ROI; however, those traveling north to Martha's Vineyard would not be in the ROI.

3.8.1.4 Marine Commerce and Shipping

The Port of New York and New Jersey is the largest port on the East Coast and the third largest in the United States, encompassing a group of ports and marine terminals in southern New York and northern New Jersey. In 2012, the Port of New York and New Jersey handled 5,529,909 loaded and unloaded TEUs. This was a 0.5 percent increase from 2011, which was an annual record for the Port of New York and New Jersey. The dollar value for the total container trade handled at the Port of New York and New Jersey was approximately $211 billion, a 1.3 percent increase from 2011. The leading trading partner for volume of imports and exports in 2011 was China, which provided 28.5 percent of the total volume at the Port of New York and New Jersey (PANYNJ 2013c).

Based on the number of vessel calls in 2011, the Port of New York and New Jersey ranked third in the United States, with a total of 4,661 calls, including tankers, container, and gas vessels (MARAD 2013). The top ports in the United States, based on the number of vessel calls in 2011, were the Port of Houston (7,218 vessel calls) and the Port of Los Angeles and Long Beach (5,364 vessel calls).

When compared to the world's ports, the Port of New York and New Jersey is ranked 29th in terms of total cargo volume (126,257,000 metric tons) and 24th in terms of container traffic (5,503,485 TEUs) (AAPA 2011).

In addition to vessel calls involving commerce, the Port of New York and New Jersey also supports a cruise industry. The Port of New York and New Jersey ranked fourth in North America with 612,000 passengers boarding cruise ships, a 9 percent increase from 2010. The top three busiest ports in North America for cruise ship departures in 2011 were Miami (1,970,000), Fort Lauderdale (1,826,000), and Port Canaveral (1,496,000) (MARAD 2012).

There are also several ferry services that travel to and from New York City, Staten Island, and Long Island, New York. Additional ferry service is provided to northern New Jersey, Connecticut, and Martha's Vineyard. None of these ferry travel lanes would cross the ROI.

3.8.1.5 OCS Resources

The BOEM's responsibilities include managing the nation's natural gas, oil, and other mineral resources on the OCS. Sand and gravel are common resources mined within the Atlantic Ocean and also managed by BOEM. The proposed Port facilities would be within Lease Blocks 6709, 6758, and 6708. The Mainline route would begin in Lease Block 6708, and traverse through Lease Blocks 6658, 6657, 6607, 6606, 6556, 6554, 6504, and 6503.

The Atlantic Region OCS is located on the eastern margin of the United States and is divided into the North Atlantic, Mid-Atlantic, South Atlantic and Straits of Florida Planning Areas. The proposed Project (Port facilities and Mainline) would be located in the North Atlantic Planning Area, which extends from Maine to New Jersey and encompasses approximately 92 million acres of seafloor on the federal OCS.

Three offshore sand borrow areas are located south of Long Island, New York. These USACE-New York District leases, granted by BOEM, are used for beach renourishment and storm damage mitigation. The sand borrow areas are located in federal waters, approximately 0.6 nautical mile from MP 16.5 to MP 19.3 of the Mainline route. The amount of dredging activity at these sites is determined by federal, state, and local requirements for beach replenishment (MMS 2004a).

3.8.2 Onshore Economic Conditions

Richmond, Kings, Queens, Nassau, and Suffolk counties would likely be utilized for onshore construction and operation support and would also be expected to be the primary source of the workforce to the extent feasible. Although other counties in New York and along the Northeast coast may be impacted due to labor force needs and material purchases, impacts are expected to be concentrated in the five counties listed above. This section provides a baseline description of population and demographics, housing, employment and income, and recreation and tourism in the counties identified within the ROI.

3.8.2.1 Population and Demographics

According to the most recent U.S. Census Bureau statistics, the population of the state of New York is estimated to have increased by 3.13 percent from 2000 to 2012 (see Table 3.8-6). The five-county region within the ROI demonstrated a 3.1 percent increase in the same time period. The largest increase in the five-county region was experienced in Richmond County (6.1 percent). The smallest increase in the five-county region was experienced in Nassau County (1.1 percent).

Table 3.8-6. Population in the Five-County ROI (2000-2012)

County/State	2000 Population a/	2012 Population b/	2000-2012 Change (%)
New York State	18,976,457	19,570,261	+3.1
Richmond County, NY	443,728	470,728	+6.1
Kings County, NY	2,465,326	2,565,635	+4.1
Queens County, NY	2,229,379	2,272,771	+1.9
Nassau County, NY	1,334,544	1,349,233	+1.1
Suffolk County, NY	1,419,369	1,499,273	+5.6
a/ Census 2000 Summary File 100-Percent Date (U.S. Census Bureau 2013) b/ People QuickFacts 2012 Estimate (U.S. Census Bureau 2013)			

The majority of the populations of Richmond, Nassau, and Suffolk County self-identify as white.[5] The population in Kings County has an even distribution between white and black individuals, and approximately 20 percent of the population identifies as Hispanic or Latino (of any race). Queens County has the largest percent of Hispanic or Latino individuals in the five-county study area, with approximately 28 percent of the population self-identifying in this category. Overall, Queens County is the most racially diverse County in the ROI, with 20 percent of the population self-identifying as Asian and almost 20 percent self-identifying as black/African American.

3.8.2.2 Housing

The total number of housing units for the five-county ROI in 2010 was 3,050,407. Table 3.8-7 depicts the total number of housing units, the median home value, and the rental vacancy rate, for the state of New York and the five-county area. The median home value for the state of New York in 2010 was $296,500. The median home value for the five-county ROI in 2010 was $467,560. The highest median home value in 2010 was $566,700 (Kings County); the lowest median home value in 2010 was $398,800 (Suffolk County).

Table 3.8-7. Housing Summary in the Five-County ROI

County/State	Total Housing Units a/	Median Home Value ($) a/	Rental Vacancy Rate a/
New York State	8,108,103	296,500	5.5
Richmond County, NY	176,656	452,300	5.6
Kings County, NY	1,000,293	566,700	4.2
Queens County, NY	835,127	464,800	4.4
Nassau County, NY	468,346	463,200	4.8
Suffolk County, NY	569,985	398,800	6.0
a/ 2007-2011 American Community Survey 5-Year Estimates (U.S. Census Bureau 2013)			

Hotel information is an important component of housing conditions. Based on information from several online travel and hotel websites, the five-county area has dozens of hotels located near the proposed Project area at estimated rates under $150 per night.

[5] According to the U.S. Census Bureau (2013), race is a self-identification data item in which respondents choose the race or races with which they most closely identify.

3.8.2.3 Employment and Income

Labor force size, employment, and unemployment statistics are provided in Table 3.8-8. The total labor force in 2012 for the five-county ROI was 3,994,390. The average unemployment rate in 2012 for the five-county ROI was 8.3 percent as compared to 8.7 percent for the state of New of York.

Table 3.8-8. Labor Force and Employment Statistics in the Five-County ROI

County/State	2012 Labor Force a/	2012 Employment a/	2012 Unemployment a/	2012 Unemployment Rate a/
New York State	9,563,000	8,733,000	830,000	8.7
Richmond County, NY	243,318	222,652	20,666	8.5
Kings County, NY	1,138,237	1,025,201	113,036	9.9
Queens County, NY	1,132,491	1,038,514	93,977	8.3
Nassau County, NY	691,336	642,463	48,873	7.1
Suffolk County, NY	789,008	728,777	60,231	7.6
a/ U.S. Department of Labor, Bureau of Labor Statistics 2012 (U.S. Census Bureau 2013)				

A comparison of industries of employment for the five-county ROI is provided in Table 3.8-9 and reveals that the education, health, and social services industry is the primary industry for all five counties, as well as the state of New York. This industry employs 26 percent of the five-county ROI. Other important industries for the five-county ROI include retail trade (10 percent average across five-county ROI); and professional, scientific, and management, and administrative and waste management services (11 percent average across five-county ROI).

Table 3.8-9. Labor Force by Industry (Percentage) in the Five-County ROI

Industry	New York a/	County				
		Richmond a/	Kings a/	Queens a/	Nassau a/	Suffolk a/
Agriculture, forestry, fishing and hunting, and mining	0.6	0.0	0.1	0.1	0.1	0.3
Construction	5.8	7.3	5.6	6.9	5.5	7.9
Manufacturing	7.1	3.0	4.6	4.9	4.9	7.8
Wholesale trade	2.7	1.9	2.5	3.0	3.7	3.4
Retail trade	10.6	9.6	9.3	10.7	10.4	11.7
Transportation and warehousing, and utilities	5.3	7.0	6.5	7.9	5.34	5.6
Information	3.0	2.6	3.9	2.8	3.1	3.0
Finance and insurance, and real estate and rental and leasing	8.5	11.6	8.2	8.8	10.7	7.5
Professional, scientific, and management, and administrative and waste management services	10.9	10.5	12.0	10.0	12.4	11.0
Educational services, and health care and social assistance	27.0	27.8	28.1	23.1	27.7	25.4

Industry	New York a/	County				
		Richmond a/	Kings a/	Queens a/	Nassau a/	Suffolk a/
Arts, entertainment, and recreation, and accommodation and food services	8.6	6.0	9.2	10.8	6.6	6.8
Other services, except public administration	5.0	4.8	5.6	6.7	4.5	4.4
Public administration	4.9	7.8	4.3	4.3	5.0	5.3
a/ 2007-2011 American Community Survey 5-Year Estimates (U.S. Census Bureau 2013)						

Income data in Table 3.8-10 reveals a range of median household incomes for the five-county ROI, from a low of $44,593 in Kings County to a high of $95,823 in Nassau County. The percentage of families living below the poverty level follows a similar trend with 18.9 percent of families living below the poverty level in Kings County and 3.8 percent of families living below the poverty level in Nassau County.

Table 3.8-10. Income and Percentage Below the Poverty Level in the Five-County ROI

County/State	Median Household Income ($) a/	Per Capita Income ($) a/	Percentage of Families Below the Poverty Level a/
New York State	56,951	31,796	11.0
Richmond County, NY	72,752	31,276	8.6
Kings County, NY	44,593	24,398	18.9
Queens County, NY	56,406	26,234	11.1
Nassau County, NY	95,823	42,307	3.6
Suffolk County, NY	87,187	36,588	3.8
a/ 2007-2011 American Community Survey 5-Year Estimates (U.S. Census Bureau 2013)			

3.8.2.4 Recreation and Tourism

A study conducted by Tourism Economics states that traveler spending in the state of New York reached a record high of $57.3 billion in 2012. The recent expansion is attributed to increased demand for rooms, increased air passenger activity at John F. Kennedy International Airport and LaGuardia Airport, and a combination of modestly higher fuel prices and additional drive visitors increasing spending at gasoline stations. More than 714,000 jobs were sustained by tourism activity in 2012, with a total income of $29 billion. The study divides the state of New York into 11 economic regions. The New York City region, which includes Richmond, Kings, and Queens counties, is the largest tourism region in the state, with 65 percent of total spending for the state. The Long Island region is the second largest tourism region in the state, with 9 percent of total spending occurring there (Tourism Economics 2012).

Onshore attractions are discussed in Section 3.7. Attractions such as state and county parks, beaches, and other natural areas in the five-county ROI support the recreation and tourism industry.

3.9 Environmental Justice

Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 *Federal Register* 7629), which requires that federal agencies' actions that "substantially affect human health or the environment…do not have the effect of excluding persons (including populations) from participation in, denying persons (including populations) the benefits of, or subjecting persons (including populations) to discrimination…because of their race, color, or national origin". The provisions of EO 12898 require that no groups of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of the adverse environmental consequences resulting from industrial, municipal, and commercial operations; or the execution of federal, state, tribal, and local programs and policies. Consideration of environmental justice concerns include race, ethnicity, and the poverty status of populations in the vicinity where a project would occur. The potential for disproportionate impacts on minority populations exists if the minority population of the affected area is greater than 50 percent, or if the proportion of the population belonging to minority groups in the area impacted by the project is substantially higher than the proportion in the surrounding area. If the potential for disproportionate impacts exists, these impacts are reviewed to determine whether they are adverse.

Guidance on environmental justice contained in USCG Commandant Instruction (COMDTINST) 5810.3, *Coast Guard Environmental Justice Strategy*, directs the USCG to "conduct its program, policies, and activities that substantially affect human health or the environment, in a manner that ensures that such programs, policies, and activities do not have the effect of excluding persons (including populations) from participation in, denying persons (including populations) the benefits of, or subjecting persons (including populations) to discrimination under such programs, policies, and activities, because of their race, color or national origin" (USCG 2010).

Environmental justice concerns are inherently incorporated in the public meetings open houses, meetings with community groups, etc., since public participation is a key tenet of EO 12898, as well as other guidance related to environmental justice. The goal of the public meetings and open houses is to engage all people that would potentially be affected by the proposed Project regardless of race or income status. Open houses were held by Liberty in conjunction with public scoping meetings held by the Maritime Administration (MARAD) and USCG on July 9 and July 10, 2013 in Long Beach, New York and Edison, New Jersey.

The following section presents the demographic data to identify potential environmental justice impacts associated with the proposed Project. Environmental justice impacts, if they occur, would be expected to occur in the New York counties closest to the proposed Project, as discussed in Section 3.8.2, since these counties are expected to be utilized for onshore construction and operations support and would be the primary source of the workforce to the extent feasible.

3.9.1 Environmental Justice Impacts

As reported in Table 3.9-1, an average of 36.3 percent of residents in the five-county ROI is of a minority race, compared to 34 percent for the state of New York. For the five-county ROI, the percent of residents who are of a minority race ranges from 17.5 percent (Suffolk County) to 57.5 percent (Queens County). Populations in two counties in the five-county ROI have a higher percentage of residents who are of a minority race than the average for the state (Kings and Queens counties). Additionally, an average of 16.4 percent of the five-county ROI population identifies itself as either black or African American, whereas this proportion is only 15.6 percent in the state of New York. Although three of the counties in the five-county ROI have greater minority populations than the state average, the potential for adverse impacts on minority populations during construction is negligible because most of the construction would occur offshore. Onshore activities would be limited to a staging area and would not affect residential areas.

With respect to income and poverty, median household income and per capita income are higher than the state average for Nassau and Suffolk counties (see Table 3.8-10). Median household income is also higher than the state average for Richmond County, although per capita income for Richmond County is lower than the state average. Median household income and per capita income are lower than the state average in Kings and Queens counties.

Table 3.9-1. Race and Ethnicity in the Five-County ROI (Percentage) a/

State/County	White	Black/African American	American Indian and Alaska Native	Asian	Native Hawaiian/Other Pacific Islander	Some Other Race	Two or More Races	Total Minority Population	Hispanic or Latino (of any race)
New York	66.0	15.6	0.4	7.3	0.0	8.2	2.3	33.8	17.4
Richmond County, NY	76.0	10.2	0.2	7.8	0.0	4.0	1.7	23.9	16.8
Kings County, NY	44.1	34.3	0.3	10.4	0.1	9.2	1.7	56.0	19.8
Queens County, NY	42.6	19.1	0.4	23.2	0.1	11.9	2.8	57.5	27.3
Nassau County, NY	73.4	11.0	0.2	7.6	0.0	5.9	1.9	26.6	14.2
Suffolk County, NY	82.5	7.4	0.2	3.4	0.0	4.8	1.7	17.5	15.9
Five-County Average	**63.7**	**16.4**	**0.3**	**10.5**	**0.0**	**7.1**	**2.0**	**36.3**	**18.8**

a/ 2007-2011 American Community Survey Five-Year Estimates (U.S. Census Bureau 2013)

Potential onshore impacts during routine operations would be limited to viewscape alterations. These minor impacts are discussed in Section 4.7.5 and would not disproportionately affect minority populations. The potential for disproportionate impacts on minority populations during decommissioning would be similar to those during construction and operation of the proposed Project. Decommissioning activities are unlikely to disproportionately affect minority populations.

3.10 Transportation

3.10.1 Regional Transportation Network

The regional transportation network in New York City and Northern New Jersey is managed by the Port Authority of New York and New Jersey (PANYNJ). Its area of jurisdiction is based on the Port of New York and New Jersey and contains the area within approximately 25 miles of the Statue of Liberty, including four bridges and two tunnels between New York and New Jersey, five airports, five marine terminals and ports, the Port Authority Bus Terminal in Manhattan, the PATH rail transit system, and the World Trade Center. The PANYNJ plans, constructs, and maintains the infrastructure required to support the region's trade and transportation network (PANYNJ 2013a).

3.10.2 Commercial and Recreational Boating Traffic

The USCG provides Vessel Traffic Services (VTS) for the major ports in the United States. New York VTS is based in Fort Wadsworth in Staten Island, New York. The VTS is responsible for coordinating all vessel traffic movements through the Port of New York and New Jersey. The USCG produces publicly available guidance documents for the use of the New York Bight, including a VTS user's manual, information for recreational vessels in federal channels, Automatic Identification System (AIS) ship data transmitting requirements, tug and barge guidelines, tow requests, and limits on anchorage areas (USCG 2013a).

Commercial boating traffic off the coasts of New York and New Jersey and in the New York Bight includes commercial fishing vessels, cruise ships, passenger ferries, and tour boats such as whale watching and sea life tours. Recreational boating and fishing aboard private, rental, party, and charter boats are very popular activities in state waters off the coasts of New York and New Jersey. Existing commercial and recreational boating activities in the vicinity of the proposed Project area are discussed in greater detail in Section 3.7.

In general, recreational boating traffic is heaviest during warm weather months, including late spring, summer, and early fall. Popular commercial fishing locations throughout the New York Bight are indicated on Figure 3.7-1. Local cruise ships remain within the Traffic Lanes described in Section 3.7.2. Passenger ferries follow routes within the New York Harbor and along the coastlines of this area to service locations in New Jersey, New York, Connecticut and Massachusetts. The locations of tour boats are dependent on the sights and views being offered by the tour boat company. Whale watching and sea life tours travel to locations where sightings are most frequent and could traverse the ROI. The majority of recreational boating and fishing occurs in inland locations, followed by state waters within 3 nautical miles from shore. A small amount of recreational boating and fishing occurs in federal waters greater than 3 nautical miles from shore where the proposed Port facilities would be located (Table 3.7-2).

3.10.3 Commercial Shipping Traffic

Commercial shipping traffic in the New York Bight include general cargo, bulk carrier, container ship, chemical tankers, liquefied petroleum gas (LPG) carriers, passenger vessels, roll-on/roll-off (RoRo) ships, and tank ships. On behalf of Liberty, Det Norske Veritas compiled and analyzed 2008 offshore traffic data available through the Maritime Association of the Port of New York and New Jersey (MAPONY 2013). The results of the analysis provided that 5 to 10 oceangoing vessels use the Ambrose to Barnegat Traffic Lane each day, 1 to 5 oceangoing vessels use the Nantucket to Ambrose/Ambrose to Nantucket, and the Barnegat to Ambrose Traffic Lanes each day, 0.5 to 1 oceangoing vessels use the Hudson Canyon to Ambrose Traffic Lanes each day, and 0.1 to 0.5 oceangoing vessels use the Ambrose to Hudson Canyon Traffic Lane each day (Liberty 2012). See Section 3.10.4 for more information on these traffic lanes.

Percentages of the types of commercial shipping vessels that use each traffic lane are provided in Table 3.10-1 (Liberty 2012). In general, the greatest percentage of vessel traffic in the traffic lanes is made up by container ships, followed by tank ships and chemical tankers.

3.10.4 Existing Traffic Lanes and Navigation

The proposed Port facilities would be located 27.1 nautical miles from the entrance to New York Harbor. As described in Section 3.7.1.1, the New York Bight has three established TSSs to allow the safe navigation of commercial shipping traffic through to New York Bight to access the New York Harbor. Each TSS consists of an inbound and an outbound shipping lane, a separation zone, and precautionary areas (Figure 3.7-1). Commercial ship traffic is directed to use the TSSs while approaching or departing the New York Harbor to prevent collisions. The three TSSs, from north to south, are the Nantucket to Ambrose/Ambrose to Nantucket Traffic Lanes, Hudson Canyon to Ambrose/Ambrose to Hudson Canyon Traffic Lanes, and the Barnegat to Ambrose/Ambrose to Barnegat Traffic Lanes. Precautionary areas are located at the offshore and inshore limits of each TSS. Smaller commercial and recreational vessels do not necessarily use the TSSs and can be found throughout the New York Bight. The proposed Port facilities would be located in the open waters between the Ambrose to Nantucket Traffic Lane and the Hudson Canyon to Ambrose Traffic Lane. The Mainline route would be installed beneath the Nantucket to Ambrose/Ambrose to Nantucket Traffic Lane.

Table 3.10-1. Vessel Type Percentages in Traffic Lanes of the New York Bight

Vessel Type	Ambrose to Barnegat	Barnegat to Ambrose	Ambrose to Hudson Canyon	Hudson Canyon to Ambrose	Ambrose to Nantucket a/	Nantucket to Ambrose a/
General Cargo	6	6	17	20	7	8
Bulk Carrier	1	1	0	2	2	2
Container Ship	57	46	1	78	62	45
Chemical Tanker	7	8	21	0	12	15
LPG Carrier	< 1	< 1	0	0	0	0
Passenger Vessel	5	7	3	0	3	5
RoRo	13	18	6	0	5	5
Tank Ship	10	14	51	0	9	20

a/ Vessel traffic counts are not publicly available for the Nantucket to Ambrose/Ambrose to Nantucket Traffic Lanes. Percentages of each vessel type included in this table were estimated based on graphical depiction.

3.11 Air Quality

3.11.1 Regional Climate

Large-scale weather features affect the entire New York City metropolitan–Long Island region, including the ROI. In the summer, prevailing winds from the south and southwest transport warm and sometimes hot, humid air masses into the area. In winter, cold air masses frequently traverse the area from the west and north. Occasionally, maritime air masses from the North Atlantic enter the area bringing cloudy skies and cool, damp weather. Storms originating in the Gulf of Mexico and Atlantic Ocean provide the moisture for most of the precipitation in the area. Fog is a frequent occurrence along the New York coast with the south shore of Long Island experiencing dense fog about 35 days per year.

The proposed Project lies in an area that is generally affected by storm systems as they exit the continent traversing west to east or southwest to northeast. Major coastal storms called “northeasters” are associated with high rainfall or snowfall amounts and can be experienced in the area from late fall through spring. Northeasters can extend over a broad area and approach hurricane intensity producing high winds and seas. Also, tropical storms, some retaining hurricane status, occasionally enter the proposed Project area, typically with an accelerated forward motion at this latitude.

The climate of the ROI would be expected to be similar to that experienced on the south shore of Long Island; however, the mesoscale climate may be different since the site location may be outside the dynamic land/water interface-influenced climate on the south shore of Long Island. Along the south shoreline of Long Island, the heating/cooling of land versus the ocean temperature can establish regional sea and land breezes, but those winds may not extend as far offshore as the proposed Project area (approximately 16 nautical miles off the Nassau County coastline).

3.11.2 Existing Ambient Air Quality

No air quality monitoring stations are located in the immediate vicinity of the proposed Port facilities as no offshore data are collected; however, there are monitoring sites in New York and New Jersey that can provide a conservative estimate of air quality in the vicinity of the proposed Project and in the ROI. The monitoring stations to be used in this assessment are located in the general proximity of major stationary sources and mobile sources (cars, trucks, buses). These types of sources are not in the vicinity of the proposed Project and as a result, the monitoring stations in New York and New Jersey provide a very conservative estimate of background air quality at the proposed Project area. The only emission sources in the vicinity of the proposed Project are the transient ship traffic frequenting the Port of New York and New Jersey and small, recreational boats that traverse the area mainly during the summer. The Washington D.C. to New York metropolitan corridor, as well as the large New York City metropolitan area, influence the ambient air quality in the vicinity of the proposed Project when the wind flow is offshore towards the proposed Port area.

Ambient air quality monitoring is conducted by state and federal environmental agencies to assess air quality. Monitoring is performed primarily for pollutants, known as criteria air pollutants, in which National Ambient Air Quality Standards (NAAQS) have been established. These pollutants include nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10}), fine particulate matter with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$), ozone (O_3), and lead (Pb).

Background air monitoring data was submitted to USEPA Region 2 on March 14, 2014 as part of the Air Permit Application and Air Quality Evaluation. USEPA accepted these as representing conservative estimates of offshore background concentrations on July 10, 2014. The air quality monitoring stations that represent conservative background pollutant concentrations within the ROI include the following:

- Veterans Park in Bayonne, New Jersey approximately 38 nautical miles west-northwest of the proposed Project in a park adjacent to a dense residential land use area and Newark Bay (NO_2, SO_2 and O_3 monitors);
- Jersey City, New Jersey approximately 37 nautical miles north-northwest of the proposed Project location in a densely populated residential area (CO monitor);
- Jersey City Firehouse, Jersey City, New Jersey approximately 38 nautical miles north-northwest of the proposed Project in a densely populated residential area (PM_{10} and $PM_{2.5}$ monitors); and
- Junior High School 126, Brooklyn, New York approximately 33 nautical miles north of the proposed Project location in a densely populated residential area (Pb monitor).

These stations are located in urban areas or densely populated residential areas that are largely developed and would be influenced by mobile sources (trucks, cars, ferries and ship traffic), power and industrial stationary sources, and residential sources. These sources would affect the ROI to a lesser degree when the wind is from the northwest through north-northeast sectors. The proposed Project area would be expected to have only transient vessel traffic contributing to pollution. Therefore, pollution advection from onshore sources is considered the primary component to background concentrations, and the use of monitoring data from inland stations as background is very conservative because ambient concentrations dissipate as the pollutant plume travels from developed land areas to the proposed Project area, miles out in the ocean. For the initial air quality analysis, the demonstration that no NAAQS would be exceeded consists of a conservative approach that adds background levels measured at these inland monitoring locations to the predicted proposed Project's concentrations. Four years of data (2010-2013) were evaluated for all pollutants except Pb. For Pb data evaluated were from 2008 and 2009 because monitoring data collection was discontinued for this pollutant at the most representative location. A summary of background concentrations measured at these stations is presented on Table 3.11-1, and NAAQS are provided in Table 3.11-2.

Table 3.11-1. Ambient Air Quality Concentrations Near the Proposed Port Ambrose Project

Pollutant	Averaging Period	Rank	Location	Measured Concentration ($\mu g/m^3$)	Year	Monitor(s)
CO	1-hour	2nd high	Jersey City, NJ	4,579	2011	A
	8-hour	2nd high	Jersey City, NJ	2,862	2012	A
NO_2	Annual	Mean	Veterans Park	33.8	2010, 2011	B
	1-hour	3-yr Avg. 98th percentile	Veterans Park	115.9	2012	B
Ozone	1-hour	2nd high	Veterans Park	208	2010	B
	8-hour	4th high	Veterans Park	161	2010	B
$PM_{2.5}$	24-hour	3-yr Avg. 98th percentile	Jersey City Firehouse	26.3	2013	C
	Annual	Mean	Jersey City Firehouse	10.9	2013	C
PM_{10}	24-hour	2nd high	Jersey City Firehouse	73	2012	C
SO_2	1-hour	3-yr Avg. 99th percentile	Veterans Park	68.9	2012	B
	3-hour	2nd high	Veterans Park	55.0	2010,2011	B
	Annual	Mean	Veterans Park	5.2	2010,2011	B
Lead	Quarterly	Maximum	Jr. High School 126	0.019	2009	D

Monitor Key:
A = 2828 Kennedy Blvd., Jersey City, NJ (monitor # 34-017-1002)
B = Veterans Park on Newark Bay, 25th St. near Park Road, Bayonne, NJ (monitor # 34-017-0006)
C = Consolidated Firehouse, 355 Newark Avenue, Jersey City, NJ (monitor # 34-017-1003)
D = 424 Leonard Street, New York, NY (monitor # 36-047-0122)

$\mu g/m^3$ = micrograms per cubic meter

Data were obtained from the USEPA/AirData, New Jersey air quality reports and the New York State air quality reports (for Pb only). The year listed in the table is the year with the highest concentration.

NO_2, SO_2, and CO are measured in parts per million (ppm). Concentrations in $\mu g/m^3$ were calculated using the following formula: $\mu g/m^3$ = ppm x MW x 40.87, where MW is the molecular weight of the pollutant and 40.87 g-mol/m^3 is the moles of gas in a cubic meter at 1 atmosphere and 25°C.

3.11.3 Air Quality Attainment Status

NAAQS were developed by the USEPA to protect public health (primary standards) and public welfare (secondary standards). Primary standards are based on observable human health responses and are set at levels that provide an adequate margin of safety for sensitive segments of the population. Secondary standards are intended to protect welfare interests such as structures, vegetation, and livestock. Air dispersion modeling is used by proposed new sources to demonstrate compliance with both the primary or secondary standards. States use ambient air monitoring systems to determine whether air quality control regions (AQCRs) are meeting the NAAQS. Areas meeting the NAAQS are termed attainment areas, and areas not meeting the NAAQS are termed nonattainment areas. Areas that have insufficient data to make a determination of attainment/nonattainment are unclassified or are not designated, but are treated as being attainment areas for permitting purposes. The designation of an area is made on a pollutant-specific basis.

Table 3.11-2. National Ambient Air Quality Standards

Pollutant	Averaging Period	Primary Standard	Secondary Standard
SO_2	3-Hour b/	--	0.5 ppm (1300 µg/m^3)
	1-hour l/, m/	75 ppb (196 µg/m^3)	--
PM_{10}	24-Hour d/	150 µg/m^3	150 µg/m^3
$PM_{2.5}$	Annual e/	12.0 µg/m^3	15.0 µg/m^3
	24-Hour f/	35 µg/m^3	35 µg/m^3
CO	8-Hour b/	9 ppm (10,000 µg/m^3)	--
	1-Hour b/	35 ppm (40,000 µg/m^3)	--
Ozone	8-Hour (2008 Standard) g/, h/	0.075 ppm (150 µg/m^3)	0.075 ppm (150 µg/m^3)
	8-Hour (1997 Standard) g/, i/	0.08 ppm (157 µg/m^3)	0.08 ppm (157 µg/m^3)
	1-Hour j/, k/	0.12 ppm (235 µg/m^3)	0.12 ppm (235 µg/m^3)
NO_2	Annual a/	53 ppb (100 µg/m^3)	53 ppb (100 µg/m^3)
	1-hour c/	100 ppb (188 µg/m^3)	--
Lead	Rolling 3-month a/	0.15 µg/m^3	0.15 µg/m^3

a/ Not to be exceeded.
b/ Not to be exceeded more than once per year.
c/ Compliance based on 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area.
d/ Not to be exceeded more than once per year on average over 3 years.
e/ Compliance based on 3-year average of weighted annual mean $PM_{2.5}$ concentrations at community-oriented monitors.
f/ Compliance based on 3-year average of 98th percentile of 24-hour concentrations at each population-oriented monitor within an area.
g/ Compliance based on 3-year average of fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area.
h/ USEPA is currently reconsidering the 8-hour ozone standard set in March 2008.
i/ The 1997 8-hour ozone standard and associated implementation rules remain in place as the transition to the 2008 standard occurs.
j/ Maximum 1-hour daily average not to be exceeded more than one day per calendar year on average.
k/ The 1-hour ozone standard has been revoked in all areas in which proposed Project activities would occur.
l/ Compliance based on 3-hear average of 99th percentile of the daily maximum 1-hour average at each monitor within an area.
m/ The 1-hour SO_2 standard was effective as of August 23, 2010.

ppm = parts per million by volume.
ppb = parts per billion by volume.
µg/m^3 = micrograms per cubic meter.

The proposed Port facilities would be due south of Jones Beach in Nassau County, New York. Nassau County is part of the New Jersey-New York-Connecticut AQCR (designated in 40 CFR 81, Subpart B). This AQCR (including Nassau County) has been designated attainment or unclassifiable by the USEPA for SO_2, CO, nitrous oxide (NO_2), PM_{10}, and Pb. Until recently, Nassau County was designated as nonattainment for both the 24-hour and annual $PM_{2.5}$ standards. However, effective April 18, 2014 Nassau County was designated attainment for $PM_{2.5}$. Nassau County was designated severe nonattainment for the 1-hour ozone standard, which was revoked by the USEPA (effective December 17, 2006). It is designated as moderate nonattainment for the 1997 8-hour ozone standard, which has not yet been revoked, and marginal nonattainment for the current 2006 8-hour ozone standard. In addition, Nassau County is within the Northeast Ozone Transport Region (NOTR). The USEPA promulgated 1-hour standards for NO_2 in February 2010 and SO_2 in June 2010. The USEPA designated New York unclassifiable/attainment for 1-hour NO_2 in a January 20, 2012 final rule. The preliminary

1-hr SO_2 designation by USEPA also has all of New York and New Jersey classified as unclassifiable/attainment. The attainment status of the AQCR and the proposed Project's potential annual emissions for each criteria pollutant are used to determine the specific air permitting requirements for the proposed Project.

3.11.4 Greenhouse Gases and Climate Change

Solar radiation is primarily responsible for the Earth's climate system. Earth's temperature has been relatively constant over many centuries. Therefore, the incoming solar energy has been nearly in balance with outgoing radiation. Of the incoming solar shortwave radiation, about half is absorbed by the Earth's surface. The fraction of this radiation reflected back to space by gases and aerosols, clouds and by the Earth's surface is approximately 30 percent, and about 20 percent is absorbed in the atmosphere. Based on the temperature of the Earth's surface the majority of the outgoing energy flux from the Earth is in the infrared part of the spectrum. The longwave radiation (also referred to as infrared radiation) emitted from the Earth's surface is largely absorbed by certain atmospheric constituents—water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and other greenhouse gases (GHGs). The downward directed component of this longwave radiation adds heat to the lower layers of the atmosphere and to the Earth's surface. This is the so-called greenhouse effect.

The most important GHGs globally are CO_2, CH_4, and N_2O and these are the key GHGs potentially emitted by as well as potentially offset by the proposed Project. The increase in GHGs in the atmosphere from human-made or anthropogenic sources since the beginning of industrialization correlates with an increase in global average temperature.

The increasing trend in GHG concentrations and the potential effect of this change in atmospheric GHG concentrations on global climate has been studied extensively and is reported by the Intergovernmental Panel on Climate Change (IPCC). The IPCC was set up in 1988 by the World Meteorological Organization and the United Nations Environment Programme to provide governments with a view of the state of knowledge about the science of climate change, potential impacts, and options for adaptation and mitigation through assessments of the most recent information published in the scientific, technical and socio-economic literature worldwide. The IPCC has released a series of reports over the past 15 years, with the latest being the Fifth Assessment Report (IPCC 2013). While the first IPCC assessment depended primarily on observed changes in surface temperature and climate model analyses, more recent assessments include multiple lines of evidence for climate change. The Fifth Assessment Report states,

> *"there is incontrovertible evidence from in situ observations and ice core records that the atmospheric concentrations of GHGs such as CO_2, CH_4, and N_2O have increased substantially over the last 200 years. In addition, instrumental observations show that land and sea surface temperatures have increased over the last 100 years. Satellites allow a much broader spatial distribution of measurements, especially over the last 30 years. For the upper ocean temperature the observations indicate that the temperature has increased since at least 1950. Observations from satellites and in situ measurements suggest reductions in glaciers, Arctic sea ice and ice sheets. In addition, analyses based on measurements of the radiative budget and ocean heat content suggest a small imbalance. These observations, all published in peer-reviewed journals, made by diverse measurement groups in multiple countries using different technologies, investigating various climate-relevant types of data, uncertainties and processes, offer a wide range of evidence on the broad extent of the changing climate throughout our planet."*

Climate change is a global issue with all regions contributing anthropogenic GHG emissions and being impacted by climate change to various degrees. The IPCC has reported that a wide range of environmental effects could result from increasing concentrations of GHGs in the atmosphere. These may include increases in sea level and changes in weather patterns resulting in changes in temperature and moisture availability on a regional basis. These weather changes can then cascade to changes in biological communities both on land and in the ocean.

Regionally, the New York State Department of Environmental Conservation reports that the following key impacts of climate change have already begun in New York and Northeastern United States (NYSDEC 2014):

- Annual average temperatures have been rising in New York for a century. The fastest increase has occurred since 1970, with state average temperatures rising by approximately 2.4ºF and winter warming exceeding 4ºF.
- Winter snow cover is decreasing and spring comes (on average) a week or so earlier than it did a few decades ago; in many areas of New York, blooming dates have advanced by as much as eight days.
- The ranges of birds that traditionally breed in New York have moved northward by as much as 40 miles in the past two decades.
- Average nighttime temperatures have risen faster than daytime temperatures and are measurably higher than they were in 1970.
- Summer heat waves are more intense, with heat-related illness and death projected to increase.
- Intense precipitation events (heavy downpours) are occurring more often.
- Sea levels along New York's ocean coast are approximately a foot higher than in 1900.
- Vector-borne infections and diseases spread by mosquitoes and ticks, such as West Nile virus and Lyme disease, are becoming more widespread throughout New York. Current changes in temperature and precipitation favor the survival of insects and other disease vectors.

GHG Regulations

Currently there are no air regulations or policies requiring permitting or control of GHG emissions specifically for the proposed Project. However, at the time that the original air permit application for the proposed Project was submitted to USEPA Region 2, a Prevention of Significant Deterioration (PSD) permit requiring the application of Best Available Control Technology (BACT) for GHGs was required under what is termed the Tailoring Rule promulgated by USEPA. Therefore, the March 2014 Air Permit Application for the proposed Project included this BACT demonstration.

On June 23, 2014, the U.S. Supreme Court determined in UARG v. EPA that certain aspects of the applicability provisions of the Tailoring Rule were invalid. The Court determined that GHG emissions cannot be a primary applicability trigger for PSD and this was the case for the proposed Project. PSD applicability in those cases reverts back to the pre-Tailoring Rule basis in which GHG emissions do not trigger any permitting requirements. The USEPA issued a guidance memorandum on July 24, 2014 stating that the USEPA intends to act consistent basis with the Court's decision and USEPA Region 2 agreed in a July 30, 2014 meeting with staff representing the proposed Project that GHG permitting is no longer required. However, the proposed Project did not retract BACT emissions controls commitments made in the original application for GHGs.

New York State participates in the Regional Greenhouse Gas Initiative (RGGI), which is a declining GHG budget cap and trade program to control and reduce greenhouse gas emissions in the Northeastern United States. This cap and trade program applies to electric utility units greater than 25 MW in size, including those in the region of the proposed Project. Therefore, it does not apply directly to the proposed Project. The proposed Project would however likely be subject to a recent USEPA GHG reporting rule that has been developed for implementation throughout the United States. In 2009, USEPA established mandatory annual GHG reporting requirements beginning in 2010 for owners and operators of certain facilities emitting greater than 25,000 metric tons per year of carbon dioxide equivalent emissions (CO_2e). The proposed Project would be included in the petroleum and natural gas systems category specified in 40 CFR 98, Subpart W. CO_2e emissions are calculated by adding all of the specified GHGs together after factoring each GHG upward by their global warming potential (GWP). For example, methane and nitrous oxide have GWPs of 25 times and 298 times that of CO_2.

Global, National, and Regional GHG Emissions

The Fifth Assessment Report of the IPCC (IPCC 2013) reports that total global GHG emissions have increased by 70 percent from 1970 to 2004, with a 24 percent increase from 1990 to 2004 alone. In total mass, these global emissions have increased from 28.7 to 49 gigatonnes of CO_2e over the 30+ year period. Notably, the largest increase, at 145 percent, over the 30+ year period came from the energy supply sector.

USEPA reports that increases have been less dramatic in the United States. In the United States, GHG emissions have increased from 6,233 to 6,526 million metric tonnes of CO_2e from 1990 through 2012 (USEPA 2014). This represents approximately a 5 percent increase.

Regionally, New York State reports a total statewide GHG emissions decrease of slightly over 8 percent from 1990 through 2011 from 230.76 to 211.74 million metric tonnes of CO_2e. New York projects that this GHG emissions total will level off through 2030 (NYSERDA 2014). Reductions have been even more dramatic in New York City. Citywide GHG emissions decreased approximately 16 percent from 2005 through 2011, from 63.6 to 53.4 million metric tonnes of CO_2e.This is more than half way to a stated citywide goal of a 30 percent reduction from 2005 GHG emissions by 2030 (PlaNYC 2012).

3.12 Noise

This section defines noise as a resource, identifies the regulatory requirements, and includes a discussion of the anticipated existing noise conditions in the ROI. The potential noise impacts and mitigation measures with respect to noise associated with construction, operation, maintenance and decommissioning for the proposed Project are discussed in Section 4.11.

Potential noise impacts are expected to occur both within air and underwater around the Port during construction and operation of the Port facilities. Specific sound metrics and measurement definitions for airborne and underwater noise are described in the following subsections.

3.12.1 Airborne Noise

The terms noise and sound are often used interchangeably. Physically there is no difference between these concepts, although it is an important distinction for the human listener. Noise is a class of sounds that are considered unwanted and in some situations noise can adversely affect the health and well-being of individuals. Consequently, noise is not typically defined solely on the basis of physical sound parameters. Rather it is defined operationally as audible acoustic energy that adversely affects, or can affect, the physiological and psychological well-being of people (Berglund and Lindvall 1995).

The standard unit of sound measurement is the decibel (dB). A dB is defined as the ratio between the measured sound pressure level (SPL) (in microPascals [μPa]) and a reference pressure (sound at a constant pressure, established by scientific standards). In air, that reference pressure is 20 μPa. The dB scale is a logarithmic measure used to quantify sound power or sound pressure that accounts for large variations in amplitude. A sound power level describes the acoustical energy of a sound and is independent of the medium in which the sound is traveling. As such, sound power levels are not measurable with a sound level meter, which only measures sound pressure levels. In air, the common reported value is A-weighted (dBA) to reflect how the human ear perceives sound. The A-weighting adjusts sound pressure levels below 1,000 hertz (Hz) and above 4,000 Hz downward. The A-weighting scale uses specific weighting of sound pressure levels from about 31.5 Hz to 8.0 kilohertz (kHz) for the purpose of determining the human response to sound. Since noise levels can vary over a given time period, they are quantified further using the equivalent sound level (L_{eq}) and day-night sound level (L_{dn}). The L_{eq} is an average of the time-varying sound energy for a specified time period. The L_{dn} is an average of the time-varying sound energy for one 24-hour period, with a 10-dB addition to the sound energy for the time period between 10 pm and 7 am. For reference purposes, typical noise levels in air and airborne sounds are presented in Table 3.12-1.

Table 3.12-1. A-Weighted Sound Levels for Some Common Airborne Sounds A-Weighted Level (dBA)

re 20 µPa	re 1 µPa	Source of Sound a/
120-140	260	Lightning strikes on water
110-120	136-146	Rock-n-roll band
100-110	126-136	Jet flyby at an altitude of 1,000 feet
90-100	116-126	Power mower b/
80-90	106-116	Heavy truck at 40 miles/hour at 49 feet; blender b/
70-80	96-106	Car at 62 miles/hour at 25 feet; clothes washer b/
60-70	86-96	Ocean surf; vacuum cleaner; air conditioner at 20 feet b/
50-60	76-86	Light traffic at 98 feet
40-50	66-76	Ocean offshore; quiet residential area – daytime
30-40	56-66	Quite residential area – nighttime
20-30	46-56	Wilderness area

a/ Source: Richardson et al. 1995.
b/ Measured at operator's position.

3.12.2 Airborne Noise Regulations

Due to the significant separation distances between the proposed Project and onshore noise-sensitive areas (NSAs), potential noise impacts are expected to be minimal; however, a regulatory review for airborne noise regulations was conducted at the state, county, and local levels.

New York State Department of Environmental Conservation Noise Guidelines

At the state level, the NYSDEC has issued guidelines under the New York State Environmental Quality Review Act (SEQRA), which are defined as an allowable incremental increase, relative to existing acoustic conditions. The NYSDEC criterion is a suggested guideline for determining the threshold for the onset of potential adverse noise impacts.

In 2001, NYSDEC published a program policy titled Assessing and Mitigating Noise Impacts, which was intended to describe an approach for the evaluation of the potential community impacts from new sound sources. The NYSDEC method is based on the perceptibility of a new sound source and recommends limits relative to the existing acoustic environment at noise-sensitive receptors (i.e., residences, schools, churches, etc.). In areas that are clearly not sensitive to noise (i.e. undeveloped areas), the application of the NYSDEC criteria may not be appropriate. Section V B(7)(c) of the policy states:

> *Increases ranging from 0-3 dB should have no appreciable effect on receptors. Increases from 3-6 dB may have potential for adverse noise impact only in cases where the most sensitive receptors are present. Sound pressure increases of more than 6 dB may require closer analysis of impact potential depending on existing sound pressure levels and the character of surrounding land use and receptors.*

Based on these guidelines, an increase of 6 dBA over the existing L_{eq} is identified as the threshold for when adverse noise impacts may begin to occur. Incremental increases of less than 6 dBA have a lower likelihood of disturbance depending in part on individual sensitivities. For potential exceedances of the 6 dBA threshold, the program policy suggests a "second level noise impact evaluation" to assess potential exceedance conditions in more detail. However, further information or guidance on what this second level evaluation may consist of is not included in the guidelines. The NYSDEC program policy further defines a typical background sound level at 45 dBA L_{eq}. If a background sound level of 45 dBA L_{eq} is assumed, the onset of potential adverse impacts occurs at cumulative sound level (e.g., Project sound levels plus background) of 51 dBA L_{eq}, or a 6 dBA increase.

New Jersey Department of Environmental Protection Noise Regulations

The NJDEP promulgated noise regulations to control noise from stationary commercial and industrial sources in 1974, pursuant to the Noise Control Act of 1971, N.J.S.A. 13:1G-1 et seq. In § 7:29-1.2, noise standards are prescribed applicable to industrial, commercial, or community service facilities. A daytime (7:00 am to 10:00 pm) broadband limit of 65 dBA is prescribed, as well as a nighttime (10:00 pm to 7:00 am) broadband limit of 50 dBA. Limits by octave band frequency are also given for daytime and nighttime periods (Table 3.12-2). Provisions for impulsive sounds are also given.

Table 3.12-2. NJDEP Octave Band Sound Pressure Level Limits

Octave Band Center Frequency (Hz)	Octave Band Sound Pressure Level (dB)	
	Daytime (7:00 am – 10:00 pm)	Nighttime (10:00 pm – 7:00 am)
31.5	96	86
63	82	71
125	74	61
250	67	53
500	63	48
1000	60	45
2000	57	42
4000	55	40
8000	53	38

Code of the City of Long Branch

The City of Long Branch is the closest location in the state of New Jersey relative to the proposed Project site. The city of Long Branch has a Code that contains noise requirements in Chapter 235 and sound level limits for both daytime and nighttime periods prescribed by receiving land use. The limits are applicably at the property line of the receiving land use except that for multifamily, high density, and/or residential projects, the limit applies at either the property line of the receiving land use or from the extremity of any unit of a project receiving the noise from any other unit, whichever is nearer (Table 3.12-3).

Table 3.12-3. City of Long Branch Sound Level Limits by Receiving Land Use

Receiving Land Use Category	Time	Sound Level Limit (dBA)
All residential and medical/hospital areas (R-1, R-2, R-3, R-4, R-5, R-6, R-7, M)	7:00 am - 10:00 pm	65
	10:00 pm – 7:00 am	50
All commercial, industrial and special areas (except the hospital) (S-1, S-2, S-3, C-1, C-2, C-3, C-4, C-5, I)	At all times	65

3.12.3 Underwater Noise

Waterborne (underwater) sound measurements are different from airborne sound measurements. When underwater objects vibrate due to activity, they create sound-pressure waves that alternately compress and decompress the water molecules as the sound wave travels through the sea. Underwater sound waves radiate in all directions away from the source (similar to ripples on the surface of a pond). The compressions and decompressions associated with sound waves are detected as changes in pressure by aquatic life and man-made sound receptors such as hydrophones.

The mechanical properties of water differ from those of air, and as a result sound moves at a faster speed in water than in air. For example, a sound wave travels at a speed of about 4,900 ft/sec in water versus about 1,100 ft/sec in air (NOAA 2010). Unlike sound traveling in air, temperature also has a significant effect on the speed of sound in water, traveling faster in warm water than in cold water. Sound propagation in water is complicated due to variations in its speed of travel through the water, interaction with the seafloor and surface, and absorptive properties of the water.

Sound pressures encountered underwater and in air range from levels just detectable by the mammal ear (hundreds of μPa) to much greater levels causing hearing damage (billions of Pa). Since this has a wide range of variation, sound pressure is normally described in terms of a SPL with units of dB referenced to a standard pressure of 1 μPa in comparison to the reference pressure in air, which is 20 μPa. Due to the differences in reference sound pressure levels, noise levels cited for air do not equal underwater levels. To compare noise levels in water to noise levels in air, one must subtract 62 dB from the noise level referenced in water. For example, a supertanker radiating noise at 190 dB (re 1 μPa at 1 meter) has an approximate equivalent noise level in air of about 128 dB (re 20 μPa at 1 meter). Table 3.12-1 presents some common airborne sound levels and their corresponding sound levels underwater. Unlike airborne noise analysis, underwater sound measurements typically do not have any frequency weighting applied (i.e., A-weighted), and in many cases, underwater noise levels are reported only for limited frequency bands (NOAA 2010).

3.12.4 Underwater Noise Regulations

A total of nine species of marine mammals (three whales, two dolphins, one porpoise, and three seals) were identified as likely present within the ROI. Three of these marine mammals are whales that are listed under the ESA as endangered, including the following species: fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), and the North Atlantic right whale (*Eubalaena glacialis*). In addition to these ESA-listed species, six additional marine mammals protected under the MMPA have the potential to transit the ROI (Port and Mainline): harbor porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), harbour seal (*Phoca vitulina*), gray seal (*Halichoerus grypus*), and harp seal (*Pagophilus groenlandicus*). Leatherback sea turtles, Kemp's ridley sea turtles, loggerhead sea turtles, green sea turtles and Atlantic sturgeon could also transit the ROI in specific months.

The most relevant laws that need to be considered when assessing the impacts of underwater sound on marine fauna are the MMPA and the *Draft Guidance for Assessing the Effect of Anthropogenic Sound on Marine Mammals* (Draft Guidance) recently issued by NOAA Fisheries (2013c). Underwater noise criteria are also given for sea turtles and fish such as Atlantic sturgeon. In addition, *the Sound Exposure Guidelines for Fishes and Sea Turtles* were recently developed within a Technical Report by the ANSI-Accredited Standards Committee and are applicable to the Project (Popper et al.). Further details on these requirements are provided in subsequent subsections.

Marine Mammal Protection Act of 1972

Underwater noise associated with the proposed Project is assessed against criteria derived from U.S. policy and recent guidance concerning marine fauna hearing. Criteria are provided by NOAA Fisheries in the MMPA, which gives Level A and B harassment criteria. Level A harassment is defined as any act of pursuit, torment or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild. Level B harassment is defined as any act of pursuit, torment or annoyance that has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering. Criteria are further distinguished as to the nature of the sound source, i.e., impulsive, continuous, etc. NOAA Fisheries defines the zone of injury as the range of received levels from 180 linear decibels (dBL) referenced to 1 µPa root mean square (RMS) (180 dBL re 1 µPa), for instantaneous sound pressure levels at a given receiver location. These guidelines are designed to protect all marine species from high sound pressure levels at any discrete frequency across the entire frequency spectrum. It is a very conservative criterion as it does not consider species-specific hearing capabilities. NOAA Fisheries defines the threshold level for Level B harassment at 160 dBL re 1µPa for impulsive sound and 120 dB for continuous sound, averaged over the duration of the signal. Table 3.12-4 summarizes the MMPA Level A and B harassment criteria.

Table 3.12-4. Summary of NMFS MMPA Criteria

	Criteria Level a/	Type
Level A Harassment	180 dBL re 1 µPa (RMS)	Absolute
Level B Harassment	160 dBL re 1 µPa (RMS) 120 dBL re 1 µPa (RMS)	Impulse Continuous
a/ FR 70 Number 7		

NOAA Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammals

Recently NOAA Fisheries issued the *Draft Guidance for Assessing the Effect of Anthropogenic Sound on Marine Mammals* (2013c) to assess the potential impacts of underwater sound sources on species-specific marine mammals. The Draft Guidance was open for public comment up until March 14, 2014, and is anticipated to be finalized and released formally sometime this year. Once finalized, the Draft Guidance is intended to be used as a tool to assess impacts of anthropogenic sound on marine fauna under the jurisdiction of the NOAA Fisheries. In the Draft Guidance, NOAA Fisheries equates the onset of permanent threshold shift (PTS) with "harm" as defined in the ESA, and with "Level A Harassment" as defined in the MMPA. As such, PTS is considered equivalent to these two types of takes. NOAA Fisheries equates temporary threshold shift (TTS) as "harassment" as defined under the ESA and "Level B Harassment" as defined in the MMPA. It is worth noting that NOAA also considers behavioral changes to constitute "harassment" and "Level B Harassment"; however, objective criteria for assessing behavioral change in marine mammals have not yet been finalized. PTS refers to a permanent increase in the threshold of audibility for an ear at a specified frequency above a previously established reference level, whereas a TTS is a temporary change in hearing sensitivity that is non-injurious and reversible.

Species of cetaceans and pinnipeds were assigned to functional hearing groups based on their hearing characteristics by Southall et al. (2007). Each functional hearing group has been assigned an M-weighting function to account for the fact that marine mammals do not hear equally well at all frequencies within their functional hearing range. M-weighting is defined by NOAA within the 2013 guidance as "a hybrid of A-weighting functions for frequencies that marine mammals are expected to be more susceptible to threshold shifts from sound exposure." This function de-emphasizes frequencies that are near the lower and upper frequency end of the estimated hearing range, where noise levels have to be higher to result in the same auditory effect (Southall et al. 2007). The M-weighting functions are similar in intent to the C-weighting function that is commonly used when assessing the impact of high-amplitude sounds on humans. Table 3.12-5 presents the estimated auditory bandwidth, species relevant to this assessment and the M-weighting function applicable for this functional hearing group.

Table 3.12-5. Marine Mammal Functional Hearing Groups

Functional Hearing Group	Estimated Auditory Bandwidth	Relevant Species to Proposed Port Ambrose Project	Functional Hearing Group M-Weighting
Low frequency (LF) cetaceans	7 Hz – 30 kHz	North Atlantic right whale Humpback whale Fin whale	M_{lf}
Mid frequency (MF) cetaceans	150 Hz – 160 kHz	Bottlenose dolphin Common dolphin	M_{mf}
High frequency (HF) cetaceans	200 Hz – 180 kHz	Harbor porpoise	M_{hf}
Phocid pinnipeds (seals)	75 Hz – 100 kHz	Harbor seal Harp seal Gray seal	M_{pp}
M_{lf} – M-weighting (low frequency) M_{mf} – M-weighting (mid frequency) M_{hf} – M-weighting (high frequency) M_{pp} – M-weighting (phocid pinnipeds)			

The recently adopted guidance included criteria distinguishing between peak SPL and cumulative sound exposure level ($_c$SEL) thresholds. Both M-weighted and unweighted SEL criteria are provided; however, NOAA Fisheries notes that the unweighted SEL criteria are likely to result in an overly conservative assessment, as they do not take into account the hearing sensitivity of the receiver functional hearing group. In order to calculate the $_c$SEL, the accumulation period must also be defined. According to the new guidance, the accumulation period is 24 hours or the length of the activity if one has “the ability to model moving animals and/or sources,” and 1 hour for situations where “modeling of movement and sound accumulation is not possible.” Furthermore, “there may be case-specific circumstances where the 1-hour accumulation time should be modified to account for situations where animals are expected to be in closer proximity to the source over a notably longer amount of time” NOAA Fisheries (2013c). Table 3.12-6 outlines the criteria from the Draft Guidance, which have been adopted for this assessment, including the proposed PTS and TTS $_c$SEL criteria for marine mammals.

Table 3.12-6. Proposed PTS and TTS $_c$SEL Criteria for Marine Mammals (NOAA Fisheries 2013c)

Hearing Group	PTS onset (dB re 1 µPa2s)		TTS onset (dB re 1 µPa2s)	
	Impulsive	Non-impulsive	Impulsive	Non-impulsive
Low frequency cetaceans (LFC)	187	198	172	178
Mid-frequency cetaceans (MFC)	187	198	172	178
High frequency cetaceans (HFC)	161	180	146	160
Phocid pinnipeds (underwater) (PPW)	192	197	177	183
Otariid Pinnipeds (underwater) (OPW)	215	220	200	206

Noise Exposure Criteria for Sea Turtles

Little is known about how sea turtles make use of sound in both terrestrial and underwater environments. There are no published underwater noise criteria for turtles in U.S. waters. Young (1991), cited in Keevin & Hempen (1997), provides an empirical safety range equation for underwater explosions from military activities for a variety of marine fauna, including turtles. The safety range was based on Gulf of Mexico oil platform criteria established by the NOAA Fisheries. Keevin & Hempen (1997) also provide details of two cases where physical injury was reported in turtles unintentionally exposed to underwater explosions, with details of the charge weight and approximate distance the injured turtle was from the blast. Substituting the values from these cases into the equations from Young (1991) gives an equivalent peak noise safety level for turtles of 222 dB_{peak} re 1 µPa. Behavioral criterion is derived from McCauley et al. (2000) who conducted tests on green and loggerhead turtles that showed increased swimming behavior when exposed to noise from air guns between levels of 166 and 75 dB_{rms} re 1 µPa (Table 3.12-7). The proposed Project underwater acoustic analysis employed the following levels for the harm and harassment criteria for turtles.

Table 3.12-7. Underwater Noise Criteria for Sea Turtles

Hearing Group	Non-auditory or Auditory Injury (dB_{peak} re 1 µPa)	Behavioral Response (dB_{rms} re 1 µPa)
	(Harm)	(Harassment)
Sea turtles	198	172

More recently, Popper et al. (2014) developed *Sound Exposure Guidelines for Fishes and Sea Turtles*, which are summarized in a technical report registered with ANSI in 2014. Guidelines are presented for a different categories of sources including explosions, pile driving, seismic airguns, naval sonar, and shipping and other continuous noise sources. In addition, the effects of sound exposure were placed into five categories such as mortality and potential mortal injury, recoverable injury, TTS, masking and behavioral effects. Of most relevance to the proposed Project are those guidelines pertaining to pile driving and shipping and other continuous noise sources. Guidelines are given in terms of dual criteria; single strike peak sound pressure level (dB_{peak} re 1 µPa) and the cumulative SEL (dB re 1 $\mu Pa^2 s$ $_c$SEL). For pile driving, guidelines are only provided for mortality and potential mortal injury, which are prescribed as 210 dB re 1 $\mu Pa^2 s$ $_c$SEL or 207 dB_{peak} re 1 µPa. Data applicable to sea turtle exposure to shipping and/or other continuous noise sources were unavailable. These sound exposure guidelines are based on the best scientific data and are to be treated as interim until further research allows refinement and completion.

Noise Exposure Criteria for Fish

Underwater noise effects to fish can include alteration of behavior, damage to auditory and non-auditory tissue, and mortality. The level of impact depends on the intensity and character of the noise, the distance to the noise source, and the size, mass and anatomical characteristics of the fish species (Hastings and Popper 2005). There are no published underwater noise criteria for Atlantic sturgeon. The injury criteria for fish from piling driving often cited comes from the Fisheries Hydroacoustic Working Group (FHWG) criteria (2008). This guidance document reports 206 dB_{peak} re 1 µPa as peak level and 187 dB re 1 $\mu Pa^2 s$ $_c$SEL for fish over 2 grams. As a conservative measure, NOAA Fisheries and USFWS generally have used SPL 150 dB re 1 µPa as the threshold for behavioral effects to ESA-listed fish species (salmon and bull trout) for most biological opinions evaluating pile driving, citing that sound pressure levels in excess of SPL 150 dB re 1 µPa can cause temporary behavioral changes (startle and stress) that could decrease a fish's ability to avoid predators (ICF Jones & Stokes 2009). The FHWG criteria does not address behavioral effects of pile driving noise on fish, as little is known regarding the threshold levels for such effects. Since no data on behavioral shifts in Atlantic sturgeon due to noise from similar construction activity exists, harassment distance for Atlantic sturgeon was not evaluated in the proposed Project underwater acoustic analysis.

As noted earlier, the more recent *Sound Exposure Guidelines for Fishes and Sea Turtles* also contain applicable sound exposure guidelines for fishes. For pile driving, guidelines were given for mortality and potential mortal injury and impairment including recoverable injury and TTS for fish with no swim bladder, fish where swim bladder is not involved in hearing, and fish where swim bladder is involved with hearing. Guidelines for fish with no swim bladder (particle motion detection) for mortality and potential mortal injury were prescribed as 219 dB re 1 μPa^2s $_c$SEL or 213 dB_{peak} re 1 µPa and the guidelines provided for recoverable injury are 216 dB re 1 μPa^2s $_c$SEL or 213 dB_{peak} re 1 µPa. Guidelines for fish with a swim bladder that is not involved in hearing (particle motion detection) for mortality and potential mortal injury were prescribed as 210 dB re 1 μPa^2s $_c$SEL or 207 dB_{peak} re 1 µPa and the guidelines provided for recoverable injury are 203 dB re 1 μPa^2s $_c$SEL or 207 dB_{peak} re 1 µPa. Guidelines for fish with a swim bladder that is involved in hearing (primarily pressure detection) for mortality and potential mortal injury were prescribed as 207 dB re 1 μPa^2s $_c$SEL or 207 dB_{peak} re 1 µPa and the guidelines provided for recoverable injury are 203 dB re 1 μPa^2s $_c$SEL or 207 dB_{peak} re 1 µPa. The guideline of 186 dB re 1 μPa^2s $_c$SEL for TTS was the same across all three groups of fishes. Regarding shopping and other continuous noise sources, there is no direct evidence of mortality or potential injury to fish; however, there is some evidence of auditory effects TTS caused by continuous noise sources on fish with a swim bladder that is involved with hearing. Guidelines for recoverable injury and TTS are 170 dB_{rms} re 1 µPa (for 48 hours) and 158 dB_{rms} re 1 µPa (for 12 hours). Again, these sound exposure guidelines are based on the best scientific data and are to be treated as interim until further research allows refinement and completion.

3.12.5 Existing Ambient Noise Conditions

Ambient sound is defined as "background environmental noise not of direct interest during a measurement or observation." The ambient sound level of a region is defined by the total noise generated, including sounds from both natural and anthropogenic sources. The received level is the sound level at the listener's position. The degree of audibility of a new or modified sound source is dependent in a large part upon the relative level of the ambient noise. The level and frequency characteristics of the ambient noise environment are two factors that control how far away a given noise source can be detected (Richardson et al. 1995). In general, noise is only detectable if it is within the audible hearing range of the receiver, and of a higher level than the ambient noise environment at similar frequencies. A lower ambient noise environment results in audible noise out to greater ranges before diminishing below the background noise level. The potential zone in which noise emissions from a source are detectable depends on the levels and types of ambient noise in the environment surrounding the noise source. This section describes the wide range of existing ambient sound levels in the ROI. These ambient sound sources contribute to the existing noise environments within the proposed ROI and are identified and described below.

3.12.5.1 Ambient Airborne Noise Conditions

Expected ambient airborne noise in the vicinity of proposed Project are dependent on existing land uses, vessel traffic, population densities, etc. and their associated in-air sound levels during both daytime and nighttime hours. As noted in Section 3.7.4, proposed Project activities would occur approximately 27.1 nautical miles offshore of shoreline within Nassau and Suffolk Counties. This nearest shoreline area is considered to be the nearest airborne NSA, which is seasonally populated with numerous beaches and waterfront recreation areas. Jones Beach and Robert Moses Beach State Parks are situated to the east and residential buildings, public boardwalks, and commercial development are located to the west within the cities of Long Beach, Point Lookout, Lido Beach, and Atlantic Beach. In addition, to the east there are some undeveloped and/or rural portions of the NSA. Vessels ranging from small non-motorized recreational vessels to large oceangoing vessels operate within the ocean between the NSA and the proposed ROI. Thus, noise-sensitive receptors are expected to include local residents, vacationers, and recreational users, as well as through travelers aboard vessels. The nearest airports, including John F. Kennedy International and Triport International, are situated approximately 33 miles to the northwest of the ROI. Therefore, the principal contributors to the ambient acoustic environment would include motor and water vehicle traffic, rail movements, periodic aircraft flyovers, and natural sounds such as birds, insects, leaf or vegetation rustle during elevated wind conditions, and wave refraction onshore. Diurnal effects result in sound levels that are typically quieter during the night than during the daytime, except during periods when evening and nighttime insect noise dominates in warmer seasons. The eastern undeveloped or rural portions of the NSA are expected to have comparatively lower ambient sound levels than expected in the western residential and commercial areas.

In the absence of Project-specific ambient measurement data, the existing sound level environment in the vicinity of the NSA was estimated with a method published by the Federal Transit Administration (FTA) in its Transit Noise and Vibration Impact Assessment (FTA 2006). This document presents the general assessment of existing noise exposure based on the population density per square mile and proximity to area sound sources such as roadways and rail lines. According to the U.S. Census Bureau, the average population per square mile within the vicinity of the NSA, including the noted cites of Long Beach, Point Lookout, Lido Beach, and Atlantic Beach, is 6,310.25 people per square mile. Table 3.12-8 presents the estimated ambient sound levels in the vicinity of the NSA; however, it is important to note that actual ambient noise levels would vary at a given location due to site-specific contribution of sound sources.

Table 3.12-8. Estimated Ambient Sound Levels in Proximity to the NSA (A-Weighted Level [dBA])

Average Sound Level (dBA)	L_{eq} a/ Day	L_{eq} a/ Evening	L_{eq} a/ Night	L_{dn} b/
	55	50	45	55

a/ L_{eq} – equivalent sound level
b/ L_{dn} – day-night average noise level
Source: FTA 2006

3.12.5.2 Ambient Underwater Noise Conditions

The ambient (background) underwater sound level at a specific location consists of contributions from a range of natural and anthropogenic sound sources, including wind and wave action, precipitation, distant shipping, sonar activity, seismic sound from volcanic and tectonic activity, thermal sound, and marine life. Ambient sound conditions vary with factors such as location, time of day, season and meteorological and oceanographic conditions. As noted in the 2014 Underwater Noise Impact Assessment for the Proposed Project, the main sources of ambient underwater noise in the waters surrounding the Port and laterals are primarily man-made shipping noise from the Port of New York and New Jersey and secondary natural noise from wind, precipitation, and surf noise in the regions closer to shore.

From 500 Hz and 100 kHz, the ambient environment is typically dominated by natural wind and wave sound level, which tends to increase with increasing wind speed. Wind generated wave action and the resultant sound levels occur over a broad range of frequencies, and the sound levels are related to the wind speed and consequent sea conditions (Richardson et al. 1995). Typical received sound levels associated with ambient underwater sound are in the range 80 to 120 dB re: $1\mu Pa^2/Hz$ over a wide frequency range, with much of the energy in the 2 to 200 Hz frequency band (OGP/IAGC 2004). Wind is generally the major contributor to underwater noise between 100 Hz and 30 kHz, while wave generated noise is a significant contribution in the infrasonic range (1 to 20 Hz). Wenz (1962) determined an empirical rule as an approximation for spectrum levels of wind-dependent ambient noise. From 500 Hz and 5 kHz, spectrum levels decrease 5 dB per octave with increasing frequency, and increase 5 dB with each doubling of wind speed from 5 to 75 km/hr. The spectrum level at 1 kHz in shallow water is 56 dB re 1 µPa2/Hz when the wind speed is 9 km/hr (i.e., Beaufort "sea state two"). In an open ocean environment, sea states of greater than four are common, resulting in wind-dependent ambient overall noise levels of 100 to 120 dB re 1 μPa.

In addition, biological species identified within the proposed ROI contribute to the existing underwater noise environment. As noted in Section 3.2.3, the oyster toadfish (*Opsanus tau*) is common within the seafloor shallow estuarine areas of New York Bight and is capable of producing (and detecting) sounds by vibrating the swim bladder. Drums, croakers (Family Sciaenidae), and searobins also produce drumming sounds by vibrating their swim bladders and are among the "noisiest" of all fish species in the ROI (Moyle and Cech 1996). Also, as noted in Section 3.3.1, the fin whale, humpback whale, and North Atlantic right whale species have been observed via acoustic detection surveys in New York Bight. Sound pressure levels in the water from some whales and dolphins have been measured in the range of 170 dB to as high as 228 dB at 1 meter (NRC 2003).

The proposed Port is located approximately 2.5 km from the closest traffic lane (Ambrose to Nantucket Traffic Lane), and 50 km to the entrance of New York Harbor. Therefore, existing ambient underwater noise levels in the ROI in the New York Bight are expected to be higher than ambient natural conditions due to frequent vessel traffic (both recreational and commercial). The Port of New York and New Jersey is considered the third busiest port in the United States by total vessel calls, with the most common vessel types being container ships, tankers, and roll on/roll off vessels (MARAD 2013). Major anthropogenic sound sources occurring offshore of the New York coast are shipping (vessel traffic such as cargo ships and petroleum tankers), commercial and recreational fishing boats, recreational vessels, sonar systems, oceanographic research, dredging/reclamation activities, and construction activities.

Shipping and service-vessel traffic is a major source of low-frequency noise (5 to 500 Hz) and includes noise from propellers, engine boats, and auxiliary systems such as diesel generators. The primary source of underwater noise from vessels is propeller cavitation; however, propeller singing, propulsion machinery/engine noise, and other onboard equipment are additional sources. Medium- and high-speed diesel engines that are built with simple connecting rods can be relatively noisy; the noise due to propulsion may exceed that of cavitations in these types of vessels. Noise associated with many ships is a strong tone between 100 and 1,000 Hz, although some broadband components of the cavitation noises may extend to 100 kHz (Richardson et al. 1995). Tonal noise from vessels is most noticeable at lower speeds, with different types of vessels producing different tonal signatures (NRC 2003). Source levels for commercial ships range from 180 to 195 dB re 1 μPa which dominate underwater noise in the 10 to 500 Hz frequency bands (NRC 2003; Hildebrand 2009; McKenna et al. 2012). Vessel traffic noise varies considerably depending upon vessel size and speed. According to the MMS, noise from small vessels ranges from 145 to 170 dB at 1 meter and very large vessels from 169 to 198 dB at 1 meter (MMS 2004b; Richardson et al. 1995).

A study conducted by the Bioacoustics Research Program at the Cornell Laboratory of Ornithology, Cornell University (2010) provided the first quantitative analysis of the background ocean noise in New York coastal waters. The acoustic monitoring equipment from this study consisted of seven marine autonomous recording units (MARUs) deployed approximately 4 to 70 nautical miles south of the Long Island, New York coast (which is in the vicinity of the proposed Project). The recording periods included a total of 258 days and included spring, fall and winter. No data were collected in the summer due to budget constraints. During the study, elevated background sound levels ranging from 100 to 140 dB for 3 to 4.5 hours/day were recorded on a daily basis in waters offshore of the Long Island coast. These results indicate that high background noise levels were present for about 30 to 50 percent of the time in the waters offshore of Long Island and appear to be largely due to the high level of shipping traffic in the region (Cornell Lab of Ornithology 2010).